

# Water Savings Opportunity Survey (WSOS) Fort Belvoir, Virginia

## *Final Report Volume 1 of 1*

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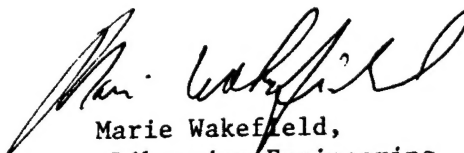


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# 1 EXECUTIVE SUMMARY

FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA

## 1.1 SYNOPSIS

Systems Corp surveyed and completed water and energy analyses for 250 representative buildings at Fort Belvoir, categorized as unaccompanied personnel housing, community facilities, administrative facilities, maintenance facilities, training facilities, family housing, hospital, heating plants, cooling towers, and water distribution systems. The water conservation opportunities (WCOs) evaluated are listed in *Table 1.1*.

Fort Belvoir's water distribution system is served by the Fairfax County Water Authority. The current rate charged to the post by Fairfax County Water Authority is \$0.67/kgal or \$0.117/kliter. Fort Belvoir's sanitary sewer discharges into a sewage treatment plant which is operated by the Department of Public Works. The current rate charged to the post is \$2.14/kgal or \$0.565/kliter. *Section 2*, par. 2.2.1, page 2-37 discusses in detail the baseline water and energy consumption at Fort Belvoir.

Cost estimates were prepared using MeansData for Windows Spreadsheets, Version 3.12. Life-cycle cost analyses were performed using the Life-Cycle Cost in Design (LCCID) computer program. Project descriptions and DD1391 forms were prepared for one Energy Conservation Investment Program (ECIP) projects. The total of the eight projects that were developed represents \$471.2K in annual water and energy savings and a total discounted savings of \$5.97M in the twenty year life of the projects. The simple paybacks average 2.95 years and the savings to investment (SIR) for the one ECIP project is 2.06. Seven Federal Energy Management Program (FEMP) Projects were developed. Each project is listed in *Table 1.1* with initial construction cost, energy savings, simple payback period, savings to investment ratio, and water and maintenance savings.

## 1.2 INTRODUCTION

Systems Engineering and Management Corporation (Systems Corp) was contracted by the Baltimore District of the United States Army Corps of Engineers to perform a water conservation study of Fort Belvoir, Virginia.

### 1.2.1 Scope of Work

1. Evaluate selected water conservation opportunities (WCOs) to determine their water savings potential and economic feasibility.

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Table 1.1 SUMMARY OF RECOMMENDED PROJECTS						
PROJECT	INITIAL COST (\$)	ENERGY SAVINGS (MWH/YR)	SIMPLE PAYBACK PERIOD (YRS)	SIR	WATER AND MAINTENANCE SAVINGS (\$)	
ECIP-1: Implementation of WCO-1: Spring Loaded Faucets in Non-Family Housing Buildings	\$698,465	1,241	7.12	2.21	\$40,620	
FEMP 1 Implementation of WCO-2: Faucet Aerators In Non-Family Housing Buildings	\$3,289	159	0.24	66.55	\$11,104	
FEMP-2 Implementation of WCO-3: Flush Valve Retrofits for Water Closets In Non-Family Housing Buildings	\$155,072	—	8.86	1.68	\$19,592	
FEMP-3: Implementation of WCO-4: Flush Valve in Retrofits for Urinals In Non-Family Housing Buildings	\$9,146	—	3.84	3.87	\$2,379	
FEMP-4: Implementation of WCO-2FH: Faucet Aerators in Family Housing Buildings	\$70,632	956	0.54	27.88	\$86,518	
FEMP-5: Implementation of WCO-3FH: Water Closet Retrofits in Family Housing Buildings	\$97,746		1.13	13.18	\$96,218	
FEMP-6: Implementation of WCO-13: Water Efficient Equipment Upgrades	\$38,469	5,174	0.38	17.84	\$7,260	
FEMP-7: Implementation of WCO-14: Repair Leaks in Water Distribution System	\$81,167		0.95	15.69	\$85,566	

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2. Conduct a limited site survey of selected buildings, family housing, heating plants, cooling towers and water distribution systems to insure any methods of water conservation which are practical and have not been evaluated in any previous study have been considered and the results documented
3. Determine efficiency of existing systems. Determine the replacement options with the highest SIR.
4. Provide complete programming or implementation documentation for all recommended WCOs.
5. Prepare a comprehensive report to document the work performed, the results, and the recommendations.

### 1.2.2 Organization of the Pre-Final Report

The submitted material for this report consists of the following: Executive Summary, Methods and Approach, ECIP Project 1, FEMP Projects 1-7, all in one volume.

### 1.3 PRESENT AND HISTORICAL WATER CONSUMPTION

The baseline water and energy consumption and the water and energy conservation opportunities were evaluated using spreadsheets to calculate water and energy consumption. These have been included in *Sections 3 through 10* of this report.

The energy costs and the Fairfax County Water Authority water and sewage costs are used to calculate the savings for the project as follows:

Cost/MBtu	
Electric	= \$0.04730/KWH or \$47.30/MWH
Natural Gas	= \$5.33/MBtu or \$18.19/MWH
Cost/Kgal	
Water	= \$0.67/KGAL or \$0.177/Kliter
Sewage	= \$2.14KGAL or \$0.565/Kliter

# 1 EXECUTIVE SUMMARY

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## 1.4 ENERGY CONSERVATION OPPORTUNITIES INVESTIGATED

Systems Corp analyzed nineteen water conservation opportunities (WCOs) at Fort Belvoir, Virginia. The analysis was performed utilizing water models developed by Systems Corp and data collected during the field survey of the facilities at Fort Belvoir. Each WCO was evaluated to determine the potential water savings, dollar savings, implementation costs, simple payback, life-cycle cost, and savings to investment ratio (SIR). The nineteen WCOs that were analyzed are as follows:

WCO-1	Spring-Loaded Faucets
WCO-2	Faucet Aerators
WCO-2FH	Faucet Aerators in Family Housing Units
WCO-3	Flush Valve Retrofits for Water Closets
WCO-3FH	Water Closet Retrofits in Family Housing Units
WCO-3AFH	Water Closet Replacement in Family Housing Units
WCO-4	Flush Valve Retrofits for Urinals
WCO-5	Water Saving Showerheads
WCO-6	Golf Course Irrigation
WCO-7	Water Efficient Appliances
WCO-8	Drinking Fountain Replacement
WCO-9	High Pressure/Hot Water/Low Volume Cleaning Tools
WCO-10	Water Source Removal in Maintenance Areas
WCO-11	Cooling Tower Automatic Blowdown/Chemical Feed
WCO-12	Boiler and Cooling Tower Chemical Treatment Improvements
WCO-13	Water Efficient Equipment Upgrades
WCO-14	Water Distribution System Leak Detection and Repair
WCO-15	Vehicle Wash Stations Centralization
WCO-16	Sensor Controlled Faucets and Flush Valves

Systems Corp's water and energy analysis models were used to determine the savings achieved for implementing each WCO in the facilities evaluated. MeansData for Windows Spreadsheets, Version 3.12 cost estimating software was used to estimate the implementation cost of each WCO in each facility evaluated. The U.S. Army Corps of Engineers' Life-Cycle Cost in Design, Version 1.0, Level 92, software was used to perform life-cycle cost analyses and determine the SIR of each WCO for each facility evaluated.

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### 1.4.1 WCOs Recommended

Systems Corp recommended WCOs evaluated to be implemented, but not in every area surveyed. The following is a list of the WCOs recommended to be implemented for selected buildings listed under each WCO. The criteria for recommendation is a favorable simple payback, and savings to investment ratio (SIR).

WCO-1	Spring-Loaded Faucets
WCO-2	Faucet Aerators
WCO-2FH	Faucet Aerators in Family Housing Units
WCO-3	Flush Valve Retrofits for Water Closets
WCO-3FH	Water Closet Retrofits in Family Housing Units
WCO-3AFH	Water Closet Replacements
WCO-4	Flush Valve Retrofits for Urinals
WCO-13	Water Efficient Equipment Upgrades
WCO-14	Water Distribution System Leak Detection and Repair

### 1.4.2 WCOs Rejected

WCO-3AFH, WCO-6, and WCO-16 were rejected due to the large investment required, the low potential savings, or the existence of a more economically feasible technology. Refer to *Appendix D* for the Life-Cycle Cost Analyses, Cost Estimates and Calculations.

### 1.4.3 ECIP and FEMP Projects Developed

Systems Corp developed one ECIP project and seven FEMP projects (See *Table 1.1*). *ECIP Project 1* consists of the replacement of the existing lavatory faucets in 189 non-family housing buildings with metering type faucets. *FEMP Project 1* consists of replacing the existing deteriorating aerators with new aerators in 106 non-family housing buildings. *FEMP Project 2* consists of retrofitting the existing water closet flush valves in 178 non-family housing buildings with new parts to reduce the volume of water per flush from 17.0 liters per flush to 13.2 liters per flush. *FEMP Project 3* consists of retrofitting the existing urinal flush valves in 33 non-family housing buildings with new parts to reduce the volume of water per use from 11.4 liters per minute to 5.7 liters per minute. *FEMP Project 4* consists of replacing the existing deteriorating aerators in 2,093 family housing units with new aerators. *ECIP Project 5* consists of replacing the flappers in the existing water

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closets in 2,093 family housing units with new early closing flappers with a savings of approximately 7.6 liters per flush (2 gallons per flush) for each water closet. *FEMP Project 6* consists of replacing 111 steam traps with new steam traps with an energy savings of 5,174 MWH/yr. and a savings of 32.0 million liters/yr. (8.64 million gallons/yr.) of water. *FEMP Project 7* consists of repairing 31 leaks in the water distribution system with a savings of 483.4 million liters/yr. (127.7 million gallons/yr.) of water.



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This section of the report describes the method and approach used by Systems Corp to complete the study. Of primary importance to the successful completion of a project of this magnitude is organization, planning and the ability to quickly document, evaluate and manipulate large amounts of data. This data must then be reduced to useable form which allows for full development of the various projects within the available funding categories. One Energy Conservation Investment Program (ECIP) project was developed and seven Federal Energy Management (FEMP) projects were developed.

### 2.1 FIELD SURVEY

The field survey as performed by Systems Corp was designed to provide the necessary data required to complete the scope of work for this project. It was also designed to provide residual benefits to the installation by providing an organized and readily available source of information which can be used in future years. The information was transmitted in the form of field notes using standardized survey forms.

The survey forms were designed to allow notations of all data which could be utilized (not necessarily required) to calculate the water and energy savings gained by implementing a specific water and energy conservation opportunity. These forms contain data obtained from as-built drawings and previous studies confirmed in the field as well as data obtained only in the field.

Thorough preparation for the building survey is required to ensure the data required to perform the technical analysis is obtained. The building surveys were performed in a manner which assured the best results. A simple listing of each step of the process best describes our approach to the surveys.

1. The list of Water and Energy Conservation Opportunities (WCOs) included in the work scope were reviewed in detail.
2. Each WCO was given an identification number which is used consistently throughout this project.
3. An expanded description of each WCO was formulated to outline the possible methods for implementation of the WCO.
4. Survey forms were developed for each WCO to provide space to enter any data which might possibly be used in performing the engineering and economic analyses of the WCO.
5. The building surveys were performed. Measurements of existing flow rates were made with the use of Micro Weir flow measuring devices.

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6. The Systems Corp survey team met with the Directorate of Public Works officer throughout the survey on an as-needed basis.

### 2.1.1 Water and Energy Conservation Opportunities

The Systems Corp's Water and Energy Conservation Team gathered field data and evaluated nineteen distinct water and energy conservation opportunities. The water and energy conservation opportunities are listed in the following table:

Table 2.1.1 WATER/ENERGY CONSERVATION OPPORTUNITIES	
WCO-1	Spring-Loaded Faucets
WCO-2	Faucet Aerators
WCO-2FH	Faucet Aerators in Family Housing Units
WCO-3	Flush Valve Retrofits for Water Closets
WCO-3FH	Water Closet Retrofits in Family Housing Units
WCO-3AFH	Water Closet Replacement in Family Housing Units
WCO-4	Flush Valve Retrofits for Urinals
WCO-5	Water Saving Showerheads
WCO-6	Golf Course Irrigation
WCO-7	Water Efficient Appliances
WCO-8	Drinking Fountain Replacement
WCO-9	High Pressure/Hot Water/Low Volume Cleaning Tools
WCO-10	Water Source Removal in Maintenance Areas
WCO -11	Cooling Tower Water Treatment
WCO-12	Boiler and Cooling Tower Chemical Treatment Improvements
WCO-13	Water Efficient Equipment Upgrades
WCO-14	Water Distribution System Leak Detection and Repair
WCO-15	Vehicle Wash Stations Centralization
WCO-16	Sensor Controlled Faucets and Flush Valves

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### 2.1.2 Water Conservation Opportunities That Were Not Evaluated

Systems Corp's Water and Energy Conservation Team surveyed all facilities before any determination of the applicability of the conservation opportunity was made. After completing the field survey, WCO-5, WCO-7, WCO-8, WCO-9, WCO-10, WCO-11, and WCO-12 were discarded.

#### 2.1.2.1 WCO-5 Water Saving Showerheads

During the field survey, it was determined that water saving 9.5 liters per minute (2.5 gallons per minute) showerheads were already in place. WCO-5 was eliminated.

#### 2.1.2.2 WCO-6 Golf Course Irrigation (South Nine Golf Course)

Based on information gathered during the site survey, watering of the greens is accomplished by the use of a hose connected to an in-ground water hydrant located at each green. According to Mr. Hicks, watering is done during the morning hours. Each green is watered for a period of ten to fifteen minutes. The following calculation shows the annual cost of watering the greens.

Estimated flow of each water hydrant..... 15 gpm  
Duration of watering at each green..... 15 minutes  
Number of greens to be watered ..... 9 greens

$$15 \text{ gpm} \cdot 15 \text{ min.} \cdot 9 \text{ greens} = 2,025 \text{ gpd}$$

$$2,025 \text{ gpd} \cdot 300 \text{ days} = 607,500 \text{ gpy}$$

At a cost of \$0.67/1,000 gallons, the annual cost to water the nine greens is \$407.03. Over a period of ten years, the total cost to water the greens is \$4,070.30. The estimated cost for an automatic irrigation system for a 9-hole golf course is \$147,000 per Means Plumbing Cost Data 1995.

Based on the above calculation, Systems Corp finds no cost savings in installing an automatic irrigation system for this South Nine golf course.

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### 2.1.2.3 WCO-7 Replace Water Consuming Appliances With More Water Efficient Models (i.e., Dishwashers and Washing Machines)

Most dishwashers observed in the family housing units appear to be in good condition. Systems Corp found no opportunities for savings relative to replacing the dishwashers and washing machines. WCO-7 was eliminated. However, when the equipment is in need of replacement, a suggestion would be to replace the equipment with more water and energy efficient models.

### 2.1.2.4 WCO-8 Replace Flowing Water Coolers With Models Using Bottled Water

Systems Corp found no opportunities for savings relative to replacing the flowing water coolers with models using bottled water. The usage amounts are insignificant, and contracting with a bottled water supplier is not cost effective. WCO-8 was eliminated.

### 2.1.2.5 WCO-9 Use of High Pressure/Hot Water/Low Volume Cleaning Tools in Maintenance Areas

Systems Corp found no opportunities for savings relative to the use of high pressure/hot water/low volume cleaning tools in maintenance areas. WCO-9 was eliminated. One suggestion is to use self-closing lever-type hose nozzles on hoses used for aircraft wash down. At the time of the survey, nozzles were not attached to hoses. The water was left running continuously during the wash down period. Aircraft wash down occurs at Buildings 3132 and 3145.

### 2.1.2.6 WCO-10 Remove Water Source From Maintenance Areas

The survey team found very few maintenance areas with high water consumption. Systems Corp found no opportunities for savings to remove the water source from the maintenance areas. WCO-10 was eliminated.

### 2.1.2.7 WCO-11 Cooling Tower Automatic Blowdown/Chemical Feed

The survey team was informed by the Directorate of Public Works that projects to automate cooling tower blowdown/chemical feed systems have been implemented for 11 cooling towers. The cooling towers, which have been automated, are listed in *Table 2.1.2.7*. Each of the cooling towers listed is

## 2 METHODS AND APPROACH

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of a capacity greater than 100 tons. Systems Corp found no additional savings in providing automatic blowdown/chemical feed systems for cooling towers less than 100-ton capacity.

### 2.1.2.8 WCO-12 Boiler and Cooling Tower Chemical Treatment Improvements

The existing central heating plants located in Buildings 332 and 1422 and the cooling towers listed in *Table 2.1.2.7* have automatic blowdown systems and a comprehensive water treatment program in place. No opportunities for improvement of the existing program were identified after reviewing the program with Fort Belvoir.

Table 2.1.2.7 COOLING TOWERS WITH AUTOMATIC BLOWDOWN/CHEMICAL FEED	
Building Number	Cooling Tower Capacity (Tons)
20	200
226	120
247	300
470	225
808	800
1084	150
1200	150
1442	115
1448	(2) 500
1746	(2) 400
2117	750
*327	150
**358	180

\*Installation of automatic chemical feed is being seriously considered at this time.

\*\*Design is currently underway for automatic chemical feed system.

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### 2.1.2.9 WCO-15 Centralize Vehicle Wash Facilities

Systems Corp found no opportunities for savings relative to centralization of the vehicle wash facilities. The wash station for the motor pool has recycling capabilities in place. The remaining wash stations consist of one water hydrant and hose at each wash station. Systems Corp recommends installing self-closing nozzles at all wash stations, including the helicopter wash station. WCO-15 was eliminated.

### 2.1.3 Buildings Not Evaluated

The scope of work delineates which water and energy conservation opportunities are to be evaluated for buildings in each category code. A real property list, sorted by category code, was appended to the scope of work. The following tables list the buildings included in the real property list for which no water conservation opportunities were evaluated. The title of each table describes the reason that no water conservation opportunities were evaluated for the buildings in each list.

*Table 2.1.3.1* is a listing of all of the buildings that were included in the real property listing, sorted by category codes, that do not have water service.

*Table 2.1.3.2* is a listing of all of the buildings that were included in the real property listing, sorted by category codes, that are abandoned or not occupied.

*Table 2.1.3.3* is a listing of all of the buildings that were included in the real property listing, sorted by category codes, that are scheduled for demolition.

*Table 2.1.3.4* is a listing of all the buildings that were included in the real property listing, sorted by category codes, that are located at Fort Belvoir in the DCEETA area, the Engineering Proving Ground and Humphrey's Engineer Center. According to the scope of work, the buildings in these areas are not included in the study.

*Table 2.1.3.5* is a listing of all the buildings that were included in the real property listing, sorted by category codes, and are non-appropriated fund facilities (AAFES).

Refer to the following tables:

## 2 METHODS AND APPROACH

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FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.

*Table 2.1.3.1 Facilities Not Surveyed Due to No Water Services*

*Table 2.1.3.2 Non-Family Housing Facilities Abandoned or Unoccupied*

*Table 2.1.3.3 Non-Family Housing Facilities Scheduled for Demolition*

*Table 2.1.3.4 Post Facilities: Non-Family Housing Facilities At Fort Belvoir  
Not in Scope for this Survey*

*Table 2.1.3.5 Post Facilities: Non-Appropriated Funds - AAFES*

## 2 METHODS AND APPROACH

FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.

Table 2.1.3.1 Fort Belvoir Real Property Listing FACILITIES NOT SURVEYED DUE TO NO WATER SERVICES						
FAC NO.	CAT CODE	DESIGNATION	SQ FTG	SEC UNIT	YR CNST	COMMENTS
FAMILY HOUSING						
Belvoir Village Housing Area						
73	71410	Detached Garages	288	1 Veh	49	Not Surveyed - No Water
82	71490	Other	60			Not Surveyed - No Water
Gerber Village Housing Area						
173	71410	Detach Garages	420	2 Veh	40	Not Surveyed - No Water
174	71410	Detach Garages	420	2 Veh	40	Not Surveyed - No Water
175	71410	Detach Garages	420	2 Veh	40	Not Surveyed - No Water
176	71410	Detach Garages	420	2 Veh	40	Not Surveyed - No Water
177	71410	Detach Garages	420	2 Veh	40	Not Surveyed - No Water
178	71410	Detach Garages	420	2 Veh	40	Not Surveyed - No Water
Rossel Loop and Jadwin Loop Village Housing Area						
443	71410	Detach Garages	1020	5 Veh	40	Not Surveyed - No Water
444	71410	Detach Garages	1020	5 Veh	40	Not Surveyed - No Water
445	71410	Detach Garages	1020	5 Veh	40	Not Surveyed - No Water
446	71410	Detach Garages	1020	5 Veh	40	Not Surveyed - No Water
456	71410	Detach Garages	1020	5 Veh	40	Not Surveyed - No Water
Fairfax Village Housing Area						
None						
George Washington Village Housing Area						
None						
Colyer Village Housing Area						
None						
Dogue Creek Village Housing Area						
None						
George Washington Village Housing Area						
None						
River Village Housing Area						
None						
Lewis Heights Housing Area						
None						
Woodlawn Village Housing Area						
None						



## 2 METHODS AND APPROACH

FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.

Table 2.1.3.1 Fort Belvoir Real Property Listing FACILITIES NOT SURVEYED DUE TO NO WATER SERVICES						
FAC NO.	CAT CODE	DESIGNATION	SQ FTG	SEC UNIT	YR CNST	COMMENTS
NON - FAMILY HOUSING						
61	76030	Cemetery		14 Ac	78	Not Surveyed - No Water
62	75010	Tennis Courts		2 Ea.		Not Surveyed - No Water
76	83230	Sewage Pump		.2 KG		Not Surveyed - No Water
77	83230	Sewage Pump		.2 KG		Not Surveyed - No Water
78	81260	Distribut Xfmr		75 KV		Not Surveyed - No Water
79	75052	Bndstnd & Pavil		1 Se		Not Surveyed - No Water
84	75052	Bndstnd & Pavil		1 Se		Not Surveyed - No Water
85	81260	Distri Xfmr		250 KV		Not Surveyed - No Water
86	81260	Distri Xfmr		167 KV		Not Surveyed - No Water
87	81260	Distri Xfmr		250 KV		Not Surveyed - No Water
88	81320	Substation		15 KV		Not Surveyed - No Water
89	81260	Distri Xfmr		250 KV		Not Surveyed - No Water
96	83114	Sew/w Tr Pl Bldg - Vac	1620	250 KG	63	Not Surveyed - No Water
97	83231	Sew Pmp Sta Bldg	1962		81	Not Surveyed - No Water
99	44270	Gen Storehouse	944	Vacant	42	Not Surveyed - No Water
179	12450	Veh Fuel Stor		10000 Ga	48	Not Surveyed - No Water
180	12480	Diesel Oil Str		500 Ga	48	Not Surveyed - No Water
185	75052	Bndstnd & Pavil		1 Se		Not Surveyed - No Water
186	87235	Dispatch Bldg	96			Not Surveyed - No Water
188	84120	Elev Wa Stor Tk		300000 Ga	18	Not Surveyed - No Water
194	81260	Distribut Xfmr		500 KV	35	Not Surveyed - No Water
195	81260	Distribut Xfmr		50 KV	35	Not Surveyed - No Water
196	81260	Distribut Xfmr		50 KV	35	Not Surveyed - No Water
197	81260	Distribut Xfmr		37.5 KV	35	Not Surveyed - No Water
198	81260	Distribut Xfmr		37.5 KV	35	Not Surveyed - No Water
199	75052	Bndstnd & Pavil		1 Se		Not Surveyed - No Water
217	72350	Detached Garages	510	1 Ve	32	Not Surveyed - No Water
218	76020	Mon/ Memorials		1 Ea	67	Not Surveyed - No Water
224	44240	Inflam Mat Sths	128		60	Not Surveyed - No Water

## 2 METHODS AND APPROACH

FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.

Table 2.1.3.1 Fort Belvoir Real Property Listing FACILITIES NOT SURVEYED DUE TO NO WATER SERVICES						
FAC NO.	CAT CODE	DESIGNATION	SQ FTG	SEC UNIT	YR CNST	COMMENTS
225	75011	Mult Ct Areas		1 Ea	83	Not Surveyed - No Water
227	75052	Bndstnd & Pavil		1 Se		Not Surveyed - No Water
228	75052	Bndstnd & Pavil		1 Se		Not Surveyed - No Water
229	75052	Bndstnd & Pavil		1 Se		Not Surveyed - No Water
232	69010	Flagpole		1 Ea	77	Not Surveyed - No Water
234	75052	Bndstnd & Pavil		1 Se		Not Surveyed - No Water
240	74076	Thtr W/ Dress Rm	15966	964 Seats	50	Not Surveyed - No Water
241	76020	Mon/ Memorials		1 Ea	77	Not Surveyed - No Water
245	75020	Baseball Field		1 Ea	49	Not Surveyed - No Water
249	44270	Gen Storehouse	312		67	Not Surveyed - No Water
250	87150	Retaining Walls		40 Lf	68	Not Surveyed - No Water
251	44270	Gen Storehouse	369		81	Not Surveyed
255	75052	Bndstnd & Pavil		1 Se		Not Surveyed - No Water
263	72335	Bn Storage Bldg	176		43	Not Surveyed - No Water
264	72335	Bn Storage Bldg	74		55	Not Surveyed - No Water
291	17120	Gen Inst Bldg	1596		68	Not Surveyed - No Water
313	44222	Stg Shed Gen Pump	800		61	Not Surveyed - No Water
332	82121	Hipr Bl + 3.5m Ol		119 MB	42	Not Surveyed - No Water
335	44220	Gen Purp Whse	11487		42	Not Surveyed - No Water
336	31920	Lab Gen Purp	1799		59	Not Surveyed - No Water
339	87230	Sentry Station	100		65	Not Surveyed - No Water
340	87230	Sentry Station	1442		42	Not Surveyed - No Water
342	82116	Heat Pl Bldg	168		62	Not Surveyed - No Water
344	44270	Gen Storehouse	800		50	Not Surveyed - No Water
345	44270	Gen Storehouse	800		50	Not Surveyed - No Water
347	44270	Gen Storehouse	8000		50	Not Surveyed - No Water
348	44270	Gen Storehouse	2400		63	Not Surveyed - No Water
349	44270	Gen Storehouse	2400		71	Not Surveyed - No Water
351	44270	Gen Storehouse	960		43	Not Surveyed - No Water
352	44240	Inflam Mat Sths	580		59	Not Surveyed - No Water
354	14131	Ops Gen Purp	3000		53	Not Surveyed - No Water
355	44240	Inflam Mat Sths	1680		78	Not Surveyed - No Water

## 2 METHODS AND APPROACH

FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.

Table 2.1.3.1 Fort Belvoir Real Property Listing FACILITIES NOT SURVEYED DUE TO NO WATER SERVICES						
FAC NO.	CAT CODE	DESIGNATION	SQ FTG	SEC UNIT	YR CNST	COMMENTS
360	44222	Stg Shed Gen Purp	870			Not Surveyed - No Water
364	87230	Sentry Station	216			Not Surveyed - No Water
376	44222	Stg Shed G Purp	500		61	Not Surveyed - No Water
378	44270	Gen Storehouse	12000		51	Not Surveyed - No Water
381	44270	Gen Storehouse	900		63	Not Surveyed - No Water
382	44270	Gen Storehouse	800		49	Not Surveyed - No Water
385	31920	Lab Gen Purp	535		62	Not Surveyed - No Water
388	44270	Gen Storehouse	1000		51	Not Surveyed - No Water
394	31920	Lab Gen Purp	1600		62	Not Surveyed - No Water
397	44270	Gen Storehouse	2400		71	Not Surveyed - No Water
422	13182	Commercial Fac	286		83	Not Surveyed - No Water
471	87150	Retaining Walls		5 Lf		Not Surveyed - No Water
472	75052	Bndstnd & Pavil		1 Se		Not Surveyed - No Water
497	75021	Softball Field		1 Ea	55	Not Surveyed - No Water
504	75052	Bndstnd & Pavil		1 Se		Not Surveyed - No Water
584	83230	Sewage Pump		145 KG	62	Not Surveyed - No Water
585	81160	Standby Generat		45 KV	80	Not Surveyed - No Water
590	81260	Distribut Xfmr		150 KV	35	Not Surveyed - No Water
591	84120	Elev Wa Stor Tk		500000 Ga	57	Not Surveyed - No Water
592	81321	Substation Bldg	88		60	Not Surveyed - No Water
593	76020	Mon/memorials		1 Ea	70	Not Surveyed - No Water
594	83230	Sewage Pump		230 KG	56	Not Surveyed - No Water
595	81160	Standby Generat		30 KV	80	Not Surveyed - No Water
600	87150	Retaining Walls		Lf	42	Not Surveyed - No Water
604	14970	Ld & Unld Docks		Ea	59	Not Surveyed - No Water
605	87150	Retaining Walls		64 Lf		Not Surveyed - No Water
606	83230	Sewage Pump		360 KG	42	Not Surveyed - No Water
607	44240	Inflam Mat Sths	352		42	Not Surveyed - No Water
608	81160	Standby Generat		30 KV	80	Not Surveyed - No Water
623	45210	Open Str Area	20000		61	Not Surveyed - No Water
625	52215	High Explo Mag	120		34	Not Surveyed - No Water
626	42235	Ready Mag	120		34	Not Surveyed - No Water

## 2 METHODS AND APPROACH

FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.

Table 2.1.3.1 Fort Belvoir Real Property Listing FACILITIES NOT SURVEYED DUE TO NO WATER SERVICES						
FAC NO.	CAT CODE	DESIGNATION	SQ FTG	SEC UNIT	YR CNST	COMMENTS
627	42235	Ready Mag	120		34	Not Surveyed - No Water
628	42225	Smokedrum Strhs	480		41	Not Surveyed - No Water
629	44220	Gen Purpse Whse	9945		44	Not Surveyed - No Water
631	44220	Gen Purpse Whse	9516		44	Not Surveyed - No Water
632	42230	Sm Arm Pyro Mag	480		41	Not Surveyed - No Water
633	42225	Smokedrum Strhs	480		34	Not Surveyed - No Water
634	42230	Sm Arm Pyro Mag	120		34	Not Surveyed - No Water
635	42250	Sp Weapons Mag	480		41	Not Surveyed - No Water
636	42210	Fuse Det Mag	480		41	Not Surveyed - No Water
637	42230	Sm Arm Pyro Mag	120		41	Not Surveyed - No Water
638	42250	Sp Weapons Mag	480		41	Not Surveyed - No Water
639	42210	Fuse Det Mag	480		41	Not Surveyed - No Water
640	42215	High Explov Mag	120		41	Not Surveyed - No Water
641	42230	Sm Arm Pyro Mag	5094		43	Not Surveyed - No Water
642	42240	Fixed Ammo Mag	756		41	Not Surveyed - No Water
643	42240	Fixed Ammo Mag	756		43	Not Surveyed - No Water
644	74062	Snack Bar	138			Not Surveyed - No Water
649	85120	Vehicle Bridge		34 Lf	59	Not Surveyed - No Water
676	44270	Gen Storehouse	960			Not Surveyed - No Water
678	44270	Gen Storehouse	960		59	Not Surveyed - No Water
686	15120	Berthing Pier		250 SY	65	Not Surveyed - No Water
687	83231	Sew Pump Sta Bdg	1562		81	Not Surveyed - No Water
689	75052	Bndstnd & Pavil		1 Se		Not Surveyed - No Water
701	44220	Gen Purp Whse	15600		46	Not Surveyed - No Water
702	44220	Gen Purp Whse	14400		46	Not Surveyed - No Water
703	45210	Open Str Area		545 SY		Not Surveyed - No Water
704	44220	Gen Purp Whse	9720		46	Not Surveyed - No Water
709	44220	Gen Purp Whse	6850		44	Not Surveyed - No Water
710	44220	Gen Purp Whse	8968		44	Not Surveyed - No Water
711	44220	Gen Purp Whse	14280		46	Not Surveyed - No Water
713	81260	Distribut Xfmr		100 KV	35	Not Surveyed - No Water
716	21458	St Clean Fac	180		50	Not Surveyed - No Water

## 2 METHODS AND APPROACH

FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.

Table 2.1.3.1 Fort Belvoir Real Property Listing FACILITIES NOT SURVEYED DUE TO NO WATER SERVICES						
FAC NO.	CAT CODE	DESIGNATION	SQ FTG	SEC UNIT	YR CNST	COMMENTS
717	12531	Pump Sta Bldg Ag	240		52	Not Surveyed - No Water
718	44240	Inflam Mat Sths	1674		56	Not Surveyed - No Water
719	12470	Htg Fuel Str		80000 Ga	52	Not Surveyed - No Water
722	75052	Bndstnd & Pavil		1 Se		Not Surveyed - No Water
726	21410	Veh Mnt Sh Org	600		60	Not Surveyed - No Water
727	87235	Dispatch Bldg	192		55	Not Surveyed - No Water
740	21920	Fe Facility	7960		34	Not Surveyed - No Water
743	44270	Gen Storehouse	10240		42	Not Surveyed - No Water
747	45210	Open Str Area		3435 SY	61	Not Surveyed - No Water
759	45210	Open Str Area		13780 SY	61	Not Surveyed - No Water
770	44240	Inflam Mat Sths	88		46	Not Surveyed - No Water
771	44240	Inflam Mat Sths	88		35	Not Surveyed - No Water
774	81160	Standby Generat		45 KV	79	Not Surveyed - No Water
780	74067	Rod Gun Club	2610		60	Not Surveyed - No Water
786	17970	Demolition Area		1 Ea	71	Not Surveyed - No Water
787	15430	Sea Walls		348 Lf	51	Not Surveyed - No Water
800	75052	Bndstnd & Pavil		1 Se		Not Surveyed - No Water
803	81320	Substation		3000 KV	56	Not Surveyed - No Water
804	76020	Mon/memorials		1 Ea	81	Not Surveyed - No Water
812	82190	Other	440	2 MB	50	Not Surveyed - No Water
814	73055	Waiting Shelter	70		77	Not Surveyed - No Water
897	85230	Foot Bridges		SY	75	Not Surveyed - No Water
898	12480	Diesel Oil Str		4000 Ga	77	Not Surveyed - No Water
899	82190	Ther (Cooling Twr)		MB	63	Not Surveyed - No Water
951	81320	Substation		3500 KV	56	Not Surveyed - No Water
952	83231	Sew Pump Sta Bd	216		57	Not Surveyed - No Water
953	85230	Footbridges		SY	75	Not Surveyed - No Water
954	81160	Standby Generat	365	50 KV	80	Not Surveyed - No Water
1002	69030	Facility Sign		1 Ea	74	Not Surveyed - No Water
1004	75052	Bndstnd & Pavil		1 Se		Not Surveyed - No Water
1005	75052	Bndstnd & Pavil		1 Se		Not Surveyed - No Water
1010	73055	Waiting Shelter	91	10 Pn		Not Surveyed - No Water

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FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.

Table 2.1.3.1 Fort Belvoir Real Property Listing FACILITIES NOT SURVEYED DUE TO NO WATER SERVICES						
FAC NO.	CAT CODE	DESIGNATION	SQ FTG	SEC UNIT	YR CNST	COMMENTS
1016	75018	Gen Purp Playgd		Ea	82	Not Surveyed - No Water
1020	75010	Tennis Courts		6 Ea	50	Not Surveyed - No Water
1021	44270	Gen Storehouse	371		40	Not Surveyed - No Water
1022	44275	Fe Storehouse	86		35	Not Surveyed - No Water
1025	73017	Post Chapel	2913		41	Not Surveyed - No Water
1029	13182	Commercial Fac				Not Surveyed - No Water
1031	83231	Sew Pump Sta Bd	120		40	Not Surveyed - No Water
1032	81160	Standby Generat	360	45 KV	80	Not Surveyed - No Water
1033	81160	Standby Generat		45 KV	80	Not Surveyed - No Water
1081	75052	Bndstnd & Pavil		1 Se		Not Surveyed - No Water
1088	81260	Distribut Xfmr		105 KV	35	Not Surveyed - No Water
1090	14970	Ld & Unld Docks		Ea	82	Not Surveyed - No Water
1100	69030	Facility Sign		Ea		Not Surveyed - No Water
1101	21710	Elec Mnt Shop	10355		42	Not Surveyed - No Water
1102	83310	Incinerator Equip		TN..	81	Not Surveyed - No Water
1105	45210	Open Str Area		5567 SY		Not Surveyed - No Water
1111	12480	Diesel Oil Stor		1000 Ga	61	Not Surveyed - No Water
1114	44270	Gen Storehouse	7200		38	Not Surveyed - No Water
1124	12310	Gas Stn Bldg	1288		34	Not Surveyed - No Water
1128	44220	Gen Purp Whse/admin	6809		88	Not Surveyed - No Water
1129	45210	Open Str Area		14896 SY		Not Surveyed - No Water
1133	44270	Gen Storehouse	4158		58	Not Surveyed - No Water
1134	44240	Inflam Mat Sths	650		49	Not Surveyed - No Water
1140	44220	Gen Purp Whse	10140		17	Not Surveyed - No Water
1141	44220	Gen Purp Whse	10060		17	Not Surveyed - No Water
1142	44220	Gen Purp Whse	10268		17	Not Surveyed - No Water
1143	44220	Gen Purp Whse	10140		17	Not Surveyed - No Water
1144	44220	Gen Purp Whse	10293		17	Not Surveyed - No Water
1145	44220	Gen Purp Whse	10126		17	Not Surveyed - No Water
1151	81260	Distribut Xfmr		225 KV	35	Not Surveyed - No Water
1156	81320	Substation & Bldg	1210	46 KV	35	Not Surveyed - No Water

## 2 METHODS AND APPROACH

FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.

Table 2.1.3.1 Fort Belvoir Real Property Listing FACILITIES NOT SURVEYED DUE TO NO WATER SERVICES						
FAC NO.	CAT CODE	DESIGNATION	SQ FTG	SEC UNIT	YR CNST	COMMENTS
1157	81160	Standby Generat	1000	100 KV	29	Not Surveyed - No Water
1158	81160	Standby Generat	2080	60 KV	43	Not Surveyed - No Water
1159	69010	Flagpole		1 Ea	50	Not Surveyed - No Water
1160	75022	Football Field		1 Ea	49	Not Surveyed - No Water
1162	73055	Waiting Shelter	252	10 Pn	72	Not Surveyed - No Water
1164	75020	Baseball Field		1 Ea	79	Not Surveyed - No Water
1172	75021	Softball Field		1 Ea		Not Surveyed - No Water
1173	75021	Softball Field		1 Ea		Not Surveyed - No Water
1176	12480	Diesel Oil Str		24000 Ga	64	Not Surveyed - No Water
1177	12450	Veh Fuel Str		24000 Ga	64	Not Surveyed - No Water
1180	12420	Tk Car Fuel Str		Ga	68	Not Surveyed - No Water
1181	12410	Ac Fuel Str Gas		2500 Ga	76	Not Surveyed - No Water
1183	81261	Distr Xfmr Bldg	86		35	Not Surveyed - No Water
1198	44240	Inflam Mat Sths	139		72	Not Surveyed - No Water
1203	69030	Facility Sign		1 Ea	64	Not Surveyed - No Water
1205	75021	Softball Field		1 Ea	74	Not Surveyed - No Water
1206	74062	Snack Bar	252		80	Not Surveyed - No Water
1298	75020	Baseball Field		1 Ea	69	Not Surveyed - No Water
1299	82420	Gas Dist Sta	228		59	Not Surveyed - No Water
1399	75052	Bndstnd & Pavil		1 Se		Not Surveyed - No Water
1401	17960	Phys Cbt Test Area		1 Ea		Not Surveyed - No Water
1402	69030	Facility Sign		1 Ea	54	Not Surveyed - No Water
1403	12530	Pump Sta Ag	140		54	Not Surveyed - No Water
1404	12480	Diesel Oil Str		25000 Ga	48	Not Surveyed - No Water
1405	12470	Htg Fuel Str		25000 Ga	48	Not Surveyed - No Water
1406	87250	Entrance Gate		Lf	77	Not Surveyed - No Water
1407	81261	Distr Xfmr Bldg	105		35	Not Surveyed - No Water
1408	69030	Facility Sign		1 Ea		Not Surveyed - No Water
1411	41140	Mtr Gas Str Fac		24 Bl	83	Not Surveyed - No Water
1412	17120	Gen Inst Bldg	5125		52	Not Surveyed - No Water
1413	81320	Substation		1875 KV	48	Not Surveyed - No Water
1421	83230	Sewage Pump		145 KG	66	Not Surveyed - No Water

## 2 METHODS AND APPROACH

FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.

Table 2.1.3.1 Fort Belvoir Real Property Listing FACILITIES NOT SURVEYED DUE TO NO WATER SERVICES						
FAC NO.	CAT CODE	DESIGNATION	SQ FTG	SEC UNIT	YR CNST	COMMENTS
1422	82121	Hipr Bl+ 3.5m Ol		139 MB	45	Not Surveyed - No Water
1423	44270	Gen Storehouse	512		59	Not Surveyed - No Water
1424	84142	Wtr Pump Sta Bd	289		36	Not Surveyed - No Water
1429	75027	Running Track		Ea	80	Not Surveyed - No Water
1432	75041	Golf Cse 9th Reg		1 Ea	35	Not Surveyed - No Water
1433	86030	Railroad Bridge		195 Lf	48	Not Surveyed - No Water
1435	14970	Ld & Unld Docks		1 Ea	59	Not Surveyed - No Water
1437	44240	Inflam Mat Sths	400		58	Not Surveyed - No Water
1438	44240	Inflam Mat Sths	400		58	Not Surveyed - No Water
1441	44240	Inflam Mat Sths	144		59	Not Surveyed - No Water
1443	85120	Vehicle Bridge		497 SY	48	Not Surveyed - No Water
1446	81360	Transformers	98	300 KV	45	Not Surveyed - No Water
1447	81160	Standby Generat		450 KV	80	Not Surveyed - No Water
1448	82633	Evap Cool Pl Bd	2292			Not Surveyed - No Water
1449	75052	Bndstnd & Pavil		1 Se		Not Surveyed - No Water
1450	75021	Softball Field		1 Ea	79	Not Surveyed - No Water
1451	87230	Sentry Station	41		75	Not Surveyed - No Water
1452	75013	Volley Ball Ct		1 Ea	77	Not Surveyed - No Water
1454	75012	Basketball Ct		1 Ea	79	Not Surveyed - No Water
1455	75012	Basketball Ct		1 Ea	77	Not Surveyed - No Water
1459	44270	Gen Storehouse	3145		83	Not Surveyed - No Water
1461	76020	Mon/memorials		1 Ea	58	Not Surveyed - No Water
1463	73055	Waiting Shelter	50		77	Not Surveyed - No Water
1470	76020	Mon/memorials		1 Ea	56	Not Surveyed - No Water
1473	75010	Tennis Courts		2 Ea	50	Not Surveyed - No Water
1476	73055	Waiting Shelter	276		61	Not Surveyed - No Water
1490	44270	Gen Storehouse	4080		66	Not Surveyed - No Water
1491	22840	Print Pl	4080		66	Not Surveyed - No Water
1493	44270	Gen Storehouse	1152		83	Not Surveyed - No Water
1495	17130	Appl Inst Bldg	8520		70	Not Surveyed - No Water
1497	44270	Gen Storehouse	4080		66	Not Surveyed - No Water
1573	75018	Gen Purp Playgd		1 Ea		Not Surveyed - No Water



## 2 METHODS AND APPROACH

FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.

Table 2.1.3.1 Fort Belvoir Real Property Listing FACILITIES NOT SURVEYED DUE TO NO WATER SERVICES						
FAC NO.	CAT CODE	DESIGNATION	SQ FTG	SEC UNIT	YR CNST	COMMENTS
1575	83230	Sewage Pump		1000 KG	60	Not Surveyed - No Water
1576	81160	Standby Generat		75 KV	80	Not Surveyed - No Water
1590	85120	Vehicle Bridge		160 Lf	59	Not Surveyed - No Water
1591	87250	Entrance Gate		1 Lf	77	Not Surveyed - No Water
1592	69030	Facility Sign		1 Ea		Not Surveyed - No Water
1695	83230	Sewage Pump		300 KG	60	Not Surveyed - No Water
1698	75070	Boat Pier Recr		1 Ea	65	Not Surveyed - No Water
1699	81160	Standby Generat		30 KV	81	Not Surveyed - No Water
1742	73055	Waiting Shelter	221	10 Pn	73	Not Surveyed - No Water
1743	17971	Obs Tower		1 Ea	74	Not Surveyed - No Water
1744	73055	Waiting Shelter	221	10 Pn	73	Not Surveyed - No Water
1746	82611	Ac Pl Ov 100 Tn.		; 400 Tn.		Not Surveyed - No Water
1807	69010	Flagpole		1 Ea	42	Not Surveyed - No Water
1808	69030	Facility Sign		1 Ea	54	Not Surveyed - No Water
1811	87230	Sentry Station	39		76	Not Surveyed - No Water
1814	12450	Veh Fuel Sta		13000 Ga	41	Not Surveyed - No Water
1820	76020	Mon/memorials		Ea		Not Surveyed - No Water
1821	89062	Cool Twr 100 Tn.		120 Tn.	68	Not Surveyed - No Water
1823	75021	Softball Field		1 Ea	78	Not Surveyed - No Water
1827	81320	Substation		3750 KV	48	Not Surveyed - No Water
1828	81160	Standby Generat		30 KV	80	Not Surveyed - No Water
1830	75052	Bndstnd & Pavil		1 Se		Not Surveyed - No Water
1832	83231	Sew Pump Sta Bldg	190		46	Not Surveyed - No Water
1833	81160	Standby Generat	420	45 KV	80	Not Surveyed - No Water
1846	85230	Foot Bridges		SY		Not Surveyed - No Water
1886	73055	Waiting Shelter	276		54	Not Surveyed - No Water
1900	75052	Bndstnd & Pavil		1 Se		Not Surveyed - No Water
1905	21452	Wveh Grease Cov	2200		81	Not Surveyed - No Water
1910	72390	Other	300		44	Not Surveyed - No Water
1913	81320	Substation		375 KV	75	Not Surveyed - No Water
1914	21470	Oil Sto Bldg	400		81	Not Surveyed - No Water
1940	76020	Mon/memorials		1 Ea		Not Surveyed - No Water

## 2 METHODS AND APPROACH

FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.

Table 2.1.3.1 Fort Belvoir Real Property Listing FACILITIES NOT SURVEYED DUE TO NO WATER SERVICES						
FAC NO.	CAT CODE	DESIGNATION	SQ FTG	SEC UNIT	YR CNST	COMMENTS
1941	12450	Veh Fuel Str		5000 Ga	63	Not Surveyed - No Water
1942	75052	Bndstnd & Pavil		1 Se		Not Surveyed - No Water
1943	44240	Inflam Mat Sths	244			Not Surveyed - No Water
1944	12480	Diesel Oil Str		5000 Ga	63	Not Surveyed - No Water
1946	21451	Tveh Grease Unc		2 Ve	63	Not Surveyed - No Water
1947	87235	Dispatch Bldg	192		63	Not Surveyed - No Water
1948	12310	Gas Sta Bldg	120		63	Not Surveyed - No Water
1952	17120	Gen Inst Bldg	1920		79	Not Surveyed - No Water
1953	17120	Gen Inst Bldg	960		79	Not Surveyed - No Water
1954	14131	Ops Gen Purp	960		79	Not Surveyed - No Water
1956	87235	Dispatch Bldg	400		84	Not Surveyed - No Water
1957	21850	Battery Shop	200		84	Not Surveyed - No Water
1958	44220	Gen Purp Whse	1960		84	Not Surveyed - No Water
1959	21883	Mtl & Wdwk Shop	2400			Not Surveyed - No Water
1963	44224	Deploy Stge Bldg	4054			Not Surveyed - No Water
1965	14970	Ld & Unld Docks		Ea	50	Not Surveyed - No Water
1967	73055	Waiting Shelter	252		72	Not Surveyed - No Water
1968	21410	Veh Mnt Sh Org	10040			Not Surveyed - No Water
1969	44270	Gen Storehouse	196		55	Not Surveyed - No Water
1970	44225	Med Supply Whse	9297		44	Not Surveyed - No Water
1971	44225	Med Supply Whse	9300		44	Not Surveyed - No Water
1972	44225	Med Supply Whse	9300		44	Not Surveyed - No Water
1973	44225	Med Supply Whse	9297		44	Not Surveyed - No Water
1975	21850	Battery Shop	400		82	Not Surveyed - No Water
1976	44220	Gen Purp Whse	8640		44	Not Surveyed - No Water
1977	44220	Gen Purp Whse	9300		44	Not Surveyed - No Water
1978	44220	Gen Purp Whse	9297		44	Not Surveyed - No Water
1979	44220	Gen Purp Whse	9297		44	Not Surveyed - No Water
1980	44220	Gen Purp Whse	9300		44	Not Surveyed - No Water
1981	44230	Cont Humid Whse	1887			Not Surveyed - No Water
1983	21546	Wash Fac Cen	1980	2ve	82	Not Surveyed - No Water
1984	21490	Other	1000		82	Not Surveyed - No Water

## 2 METHODS AND APPROACH

FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.

Table 2.1.3.1 Fort Belvoir Real Property Listing FACILITIES NOT SURVEYED DUE TO NO WATER SERVICES						
FAC NO.	CAT CODE	DESIGNATION	SQ FTG	SEC UNIT	YR CNST	COMMENTS
1985	21454	Wplat Org Lp	3629	2 Ve	82	Not Surveyed - No Water
1986	21455	Wplat Org Hp		6 Ve	82	Not Surveyed - No Water
1987	21481	Wtr & Grit Sep			83	Not Surveyed - No Water
1988	21460	O Service Pad		5110 SY		Not Surveyed - No Water
1990	12450	Veh Fuel Str		12000 Ga	66	Not Surveyed - No Water
1991	12480	Diesel Oil Str		12000 Ga	63	Not Surveyed - No Water
2114	75052	Bndstnd & Pavil		1 Se	75	Not Surveyed - No Water
2117	89046	Comb Ac Ht Bldg			75	Not Surveyed - No Water
2121	76020	Mon/memorials		1 Ea	67	Not Surveyed - No Water
2122	76020	Mon/memorials		1 Ea	67	Not Surveyed - No Water
2123	75010	Tennis Courts	207	4 Ea	79	Not Surveyed - No Water
2125	75012	Basketball Ct		Ea	81	Not Surveyed - No Water
2126	75020	Baseball Field		1 Ea	81	Not Surveyed - No Water
2157	82711	Cwtr Dis 100 Tn.		134.8 Tn.	75	Not Surveyed - No Water
2158	87190	Other		800 Lf	76	Not Surveyed - No Water
2159	75021	Softball Field		1 Ea	82	Not Surveyed - No Water
2160	73055	Waiting Shelter		1 Pn	84	Not Surveyed - No Water
2280	45210	Open Str Area		14000 SY	69	Not Surveyed - No Water
2281	86070	Rr Coal Trestle		642 Lf	42	Not Surveyed - No Water
2287	75060	Stadium	1800	5000 Se	42	Not Surveyed - No Water
2288	13210	Antenna Tower		Ea	78	Not Surveyed - No Water
2290	13160	Xmtr Bldg Radio			42	Not Surveyed - No Water
2298	86030	Railroad Bridge		195 Lf	48	Not Surveyed - No Water
2311	83230	Sewage Pump		1 KG		Not Surveyed - No Water
2313	13160	Xmtr Bldg Radio				Not Surveyed - No Water
2368	75021	Softball Field		1 Ea	78	Not Surveyed - No Water
2370	74074	Scout Bldg			86	Not Surveyed - No Water
2371	72321	Det Latrine Bldg				Not Surveyed - No Water
2428	84120	Elev Wa Stor Tk	300	500000 Ga	48	Not Surveyed - No Water
2429	84120	Elev Wa Stor Tk		1000000 Ga	48	Not Surveyed - No Water
2431	75030	Outdr Swim Pool		1 Ea	43	Not Surveyed - No Water
2433	75010	Tennis Courts		1 Ea	50	Not Surveyed - No Water

## 2 METHODS AND APPROACH

FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.

Table 2.1.3.1 Fort Belvoir Real Property Listing FACILITIES NOT SURVEYED DUE TO NO WATER SERVICES						
FAC NO.	CAT CODE	DESIGNATION	SQ FTG	SEC UNIT	YR CNST	COMMENTS
2434	74141	Pump Sta	239		41	Not Surveyed - No Water
2443	84310	Fire Prt Pmp St	672			Not Surveyed - No Water
2445	87230	Sentry Station	80			Not Surveyed - No Water
2446	84141	Pump Sta	36		49	Not Surveyed - No Water
2450	82120	Heat Plant Oil	916			Not Surveyed - No Water
2452	81160	Standby Generat		450 KV	80	Not Surveyed - No Water
2454	83231	Sew Pump Sta Bd	196		63	Not Surveyed - No Water
2463	87230	Sentry Station	312	Vacant		Not Surveyed - No Water
2464	87230	Sentry Station	151	Vacant		Not Surveyed - No Water
2465	87230	Sentry Station	151	Vacant		Not Surveyed - No Water
2471	69010	Flagpole		1 Ea	75	Not Surveyed - No Water
2472	81320	Substation		2500 KV	59	Not Surveyed - No Water
2473	21885	Mnt Sh Gen Purp	7550		75	Not Surveyed - No Water
2474	21450	Wveh Grease Unc		1 Ve	75	Not Surveyed - No Water
2475	21454	Wplat Org Lp		1 Ve	75	Not Surveyed - No Water
2476	21410	Veh Mnt Sh Org	5060		63	Not Surveyed - No Water
2478	45210	Open Str Area	23300			Not Surveyed - No Water
2479	83231	Sew Pump Sta Bd	213		57	Not Surveyed - No Water
2486	86030	Railroad Bridge		53 Lf	42	Not Surveyed - No Water
2513	84220	Water Pump P		1 Lf	59	Not Surveyed - No Water
2516	85120	Vehicle Bridge		SY	81	Not Surveyed - No Water
2540	81350	No Assignment				Not Surveyed - No Water
2571	81180	Pwr Pl Bldg Oth	414		74	Not Surveyed - No Water
2609	73055	Waiting Shelter	119	10 Pn		Not Surveyed - No Water
2657	73055	Waiting Shelter	119	10 Pn		Not Surveyed - No Water
2658	73055	Waiting Shelter	119	10 Pn		Not Surveyed - No Water
2689	85190	Other		6490 SY	89	Not Surveyed - No Water
2690	73055	Waiting Shelter	119	10 Pn	82	Not Surveyed - No Water
2721	73055	Waiting Shelter	119	10 Pn		Not Surveyed - No Water
2777	73055	Waiting Shelter	119	10 Pn	89	Not Surveyed - No Water
2788	75012	Basketball Court		3 Ea	82	Not Surveyed - No Water
2789	75021	Softball Field		1 Ea	82	Not Surveyed - No Water

## 2 METHODS AND APPROACH

FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.

Table 2.1.3.1 Fort Belvoir Real Property Listing FACILITIES NOT SURVEYED DUE TO NO WATER SERVICES						
FAC NO.	CAT CODE	DESIGNATION	SQ FTG	SEC UNIT	YR CNST	COMMENTS
2790	75010	Tennis Courts		2 Ea	82	Not Surveyed - No Water
2795	81321	Substation Bldg	105			Not Surveyed - No Water
2870	13210	Antenna Tower		1 Ea		Not Surveyed - No Water
2900	75040	Golf Cse 18th Reg		1 Ea		Not Surveyed - No Water
2902	84120	Elev Wa Stor Tk		75000 Ga	57	Not Surveyed - No Water
2904	44270	Gen Storehouse	2016		59	Not Surveyed - No Water
2905	44270	Gen Storehouse	2425		59	Not Surveyed - No Water
2906	44240	Inflam Mat Sths	48		82	Not Surveyed - No Water
2907	74031	Golf Course Mnt	2279		74	Not Surveyed - No Water
2909	74030	Golf Club House	2880		75	Not Surveyed - No Water
2910	85230	Foot Bridges		91 SY	60	Not Surveyed - No Water
2911	85230	Foot Bridges		118 SY	60	Not Surveyed - No Water
2913	84470	Well Np w/ps		30.8 KG	59	Not Surveyed - No Water
2914	84470	Well Np w/ps		12.2 KG	59	Not Surveyed - No Water
2915	85230	Foot Bridges		SY	60	Not Surveyed - No Water
2951	69030	Facility Sign		1 Ea	64	Not Surveyed - No Water
2991	44285	Salv & Sur Prop	24235		61	Not Surveyed - No Water
2992	45210	Open Str Area		39607 SY	81	Not Surveyed - No Water
3013	69030	Facility Sign		1 Ea	54	Not Surveyed - No Water
3014	83330	Sanitary Landfill		60000 Tn.	77	Not Surveyed - No Water
3015	73075	Public Toilet	488			Not Surveyed - No Water
3016	75080	Fish/wildlife		700 Ac	80	Not Surveyed - No Water
3017	85230	Foot Bridges		SY	81	Not Surveyed - No Water
3018	85120	Vehicle Bridge		400 SY	81	Not Surveyed - No Water
3037	13415	R Bea Mkr 75 Mc		Ea		Not Surveyed - No Water
3041	74049	Riding Stable	1760			Not Surveyed - No Water
3042	84131	Water Well W/ps		KG		Not Surveyed - No Water
3061	17970	Demolition Area		1 Ea	66	Not Surveyed - No Water
3062	17970	Demolition Area		1 Ea		Not Surveyed - No Water
3064	17990	Other				Not Surveyed - No Water
3065	17120	Gen Inst Bldg	3220		66	Not Surveyed - No Water
3067	44270	Gen Storehouse	454	Vacant	66	Not Surveyed - No Water

## 2 METHODS AND APPROACH

FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.

Table 2.1.3.1 Fort Belvoir Real Property Listing FACILITIES NOT SURVEYED DUE TO NO WATER SERVICES						
FAC NO.	CAT CODE	DESIGNATION	SQ FTG	SEC UNIT	YR CNST	COMMENTS
3068	44270	Gen Storehouse	454	Vacant	66	Not Surveyed - No Water
3069	17120	Gen Inst Bldg	3220		66	Not Surveyed - No Water
3070	17120	Gen Inst Bldg	3220		66	Not Surveyed - No Water
3071	44270	Gen Storehouse	454	Vacant	66	Not Surveyed - No Water
3072	42215	High Explo Mag	24		66	Not Surveyed - No Water
3073	84131	Water Well w/ps	24		67	Not Surveyed - No Water
3074	17170	Gas Chamber	820		67	Not Surveyed - No Water
3075	17170	Gas Chamber	756		67	Not Surveyed - No Water
3078	17970	Demolition Area		1 Ea	58	Not Surveyed - No Water
3085	14131	Ops Gen Purp	240		58	Not Surveyed - No Water
3091	17970	Demolition Area		Ea	58	Not Surveyed - No Water
3092	17990	Other			59	Not Surveyed - No Water
3097	42235	Ready Magazine	24	Vacant	66	Not Surveyed - No Water
3098	42215	High Explo Mag	24	Vacant	66	Not Surveyed - No Water
3099	44270	Gen Storehouse	413	Vacant		Not Surveyed - No Water
3100	11110	Fw Runway		60843 SY	54	Not Surveyed - No Water
3101	11210	Std Taxiway		24337 SY	54	Not Surveyed - No Water
3102	11382	Sp Purp Apr		SY		Not Surveyed - No Water
3103	11382	Sp Purp Apr		SY		Not Surveyed - No Water
3104	11140	Hoverpoint		5708 SY	81	Not Surveyed - No Water
3105	11130	Hlp & Hel Park		711 SY	81	Not Surveyed - No Water
3106	11370	Ac Wash Apron		835 SY	81	Not Surveyed - No Water
3107	11370	Ac Wash Apron		739 SY	59	Not Surveyed - No Water
3108	11130	Hlp & Hel Park		623 SY		Not Surveyed - No Water
3109	11330	Ac Mt Pk Apron		25137 SY	58	Not Surveyed - No Water
3110	11610	Comp Swing Base		SY	57	Not Surveyed - No Water
3111	13610	Runway Ltg-mi		72582 Lf	60	Not Surveyed - No Water
3122	44240	Inflam Mat Sths	822		81	Not Surveyed - No Water
3125	44276	Str Mat Hand Eq	1152		76	Not Surveyed - No Water
3127	44270	Gen Storehouse	1581			Not Surveyed - No Water
3129	81360	Transformers		KV		Not Surveyed - No Water
3130	21885	Mnt Sh Gen Purp	1000			Not Surveyed - No Water

## 2 METHODS AND APPROACH

FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.

Table 2.1.3.1 Fort Belvoir Real Property Listing FACILITIES NOT SURVEYED DUE TO NO WATER SERVICES						
FAC NO.	CAT CODE	DESIGNATION	SQ FTG	SEC UNIT	YR CNST	COMMENTS
3131	14112	Avn Ops Bldg	264		60	Not Surveyed - No Water
3135	69010	Flagpole		Ea	77	Not Surveyed - No Water
3140	21111	Mnt Hangar Avim	24606		55	Not Surveyed - No Water
3142	44210	Ac Pts Str Bldg	1092			Not Surveyed - No Water
3144	44215	Oxy Storage Fac	230			Not Surveyed - No Water
3150	44270	Gen Storehouse	320		74	Not Surveyed - No Water
3152	81360	Transformers		KV	62	Not Surveyed - No Water
3154	44222	Stg Shed G Purp	404			Not Surveyed - No Water
3160	12120	Ac Trk Fuel Fac			61	Not Surveyed - No Water
3161	12120	Ac Trk Fuel Fac	464		61	Not Surveyed - No Water
3162	12411	Ac Fuel Str Jet		20000 Ga	61	Not Surveyed - No Water
3164	75052	Bndstnd & Pavil		1 Se		Not Surveyed - No Water
3170	44270	Gen Storehouse	590		58	Not Surveyed - No Water
3171	44240	Inflam Mat Sths	200		60	Not Surveyed - No Water
3172	13160	Xmtr Bldg Radio	525		75	Not Surveyed - No Water
3173	81360	Transformers		75 KV	75	Not Surveyed - No Water
3174	13210	Antenna Tower		1 Ea	75	Not Surveyed - No Water
3176	44240	Inflam Mat Sths			84	Not Surveyed - No Water
3177	17966	Rapelling Tr Ar		1 Ea	87	Not Surveyed - No Water
3178	17966	Rapelling Tr Ar		Ea		Not Surveyed - No Water
3180	84120	Elev Wa Stor Tk		300000 Ga	58	Not Surveyed - No Water
3185	13420	Radio Beac Tvor	Vacant	1 Ea	81	Not Surveyed - No Water
3186	17950	Confidence Cse		1 Ea	87	Not Surveyed - No Water
3190	87230	Sentry Station	72		76	Not Surveyed - No Water
3200	11120	Rw Runway		5618 SY	56	Not Surveyed - No Water
3202	11310	Fw Ac Pk Apron		3079 SY	61	Not Surveyed - No Water
3203	11320	Rw Ac Pk Apron		87218 SY	62	Not Surveyed - No Water
3210	13440	Inst Land Sys		1 Ea	67	Not Surveyed - No Water
3211	13470	Lt Wind Dir Ind		1 Ea	60	Not Surveyed - No Water
3212	13430	Ground Cont Sys		Ea	59	Not Surveyed - No Water
3213	13440	Inst Land Sys		Ea	64	Not Surveyed - No Water
3214	13470	Lt Wind Dir Ind		Ea		Not Surveyed - No Water

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FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.

Table 2.1.3.1 Fort Belvoir Real Property Listing FACILITIES NOT SURVEYED DUE TO NO WATER SERVICES						
FAC NO.	CAT CODE	DESIGNATION	SQ FTG	SEC UNIT	YR CNST	COMMENTS
3215	13470	Lt Wind Dir Ind		Ea		Not Surveyed - No Water
3216	13420	Radio Beac Tvor		Ea		Not Surveyed - No Water
3217	13440	Inst Land Sys		Ea		Not Surveyed - No Water
3233	82122	Ht Pl + 3.5mm OI		4686 MB		Not Surveyed - No Water
3236	44240	Inflam Mat Sths	200		60	Not Surveyed - No Water
3238	81260	Distribut Xfmr		225 KV	58	Not Surveyed - No Water
3239	13640	Ltg Eqp Vault	559		59	Not Surveyed - No Water
3250	17990	Other			79	Not Surveyed - No Water
3260	87230	Sentry Station	72		76	Not Surveyed - No Water
3265	85120	Vehicle Bridge		68 SY/62 Lf	48	Not Surveyed - No Water
3270	75018	Gen Purp Playgd		Ea	83	Not Surveyed - No Water
3290	85120	Vehicle Bridge		302 SY/92 Lf	76	Not Surveyed - No Water
3291	85120	Vehicle Bridge		356 SY/100 Lf		Not Surveyed - No Water
5000	87230	Sentry Station	190		51	Not Surveyed - No Water
5008	12450	Veh Fuel Str		10000 Ga	43	Not Surveyed - No Water
5010	21885	Mnt Sh Gen Purp	12690	Vacant	49	Not Surveyed - No Water
5014	14180	Scale House	120	Vacant	49	Not Surveyed - No Water
5015	44240	Inflam Mat Sths	417	Vacant	62	Not Surveyed - No Water
5021	87235	Dispatch Bldg	1152	Vacant	59	Not Surveyed - No Water
5032	12480	Diesel Oil Str	Vacant	2500 Ga	59	Not Surveyed - No Water
5033	44270	Gen Storehouse	3721	Vacant	58	Not Surveyed - No Water
5034	31920	Lab Gen Purp	21565		59	Not Surveyed - No Water
5035	31920	Lab Gen Purp	608	Vacant	59	Not Surveyed - No Water
5036	44270	Gen Storehouse	240	Vacant	59	Not Surveyed - No Water
5038	12480	Diesel Oil Str	Vacant	12400 Ga	47	Not Surveyed - No Water
5040	31920	Lab Gen Purp	960	Vacant	58	Not Surveyed - No Water
5041	21458	St Clean Fac	690	Vacant	64	Not Surveyed - No Water
5042	39090	Other		1 Ea	59	Not Surveyed - No Water
5065	85120	Vehicle Bridge		293 SY/12 Lf	63	Not Surveyed - No Water
5066	42240	Fixed Ammo Mag	112	Vacant	68	Not Surveyed - No Water
5067	42240	Fixed Ammo Mag	112		68	Not Surveyed - No Water
5068	14930	Barr Explosive	735	Vacant	63	Not Surveyed - No Water



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FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.

Table 2.1.3.1 Fort Belvoir Real Property Listing FACILITIES NOT SURVEYED DUE TO NO WATER SERVICES						
FAC NO.	CAT CODE	DESIGNATION	SQ FTG	SEC UNIT	YR CNST	COMMENTS
5069	39090	Other	735	Vacant	62	Not Surveyed - No Water
5070	14930	Barr Explosive		Vacant	46	Not Surveyed - No Water
5071	42215	High Explo Mag	1080		54	Not Surveyed - No Water
5072	42215	High Explo Mag	1080		54	Not Surveyed - No Water
5073	61060	Admin Bldg R & D	13618		54	Not Surveyed - No Water
5074	14930	Barr Explosive	276	Vacant	65	Not Surveyed - No Water
5075	31920	Lab Gen Purp	1071	Vacant	63	Not Surveyed - No Water
5076	42215	High Explo Mag	81		63	Not Surveyed - No Water
5077	42215	High Explo Mag	71		63	Not Surveyed - No Water
5078	84131	Water Well W/ps		5.7 KG	63	Not Surveyed - No Water
5079	87140	Dykes or Dams		79 Lf	66	Not Surveyed - No Water
5080	83120	Sep Tk Drn Fld		KG	73	Not Surveyed - No Water
5087	39038	Gn Tran Eqp Fac		1 Ea	64	Not Surveyed - No Water
5088	42215	High Explo Mag	81		43	Not Surveyed - No Water
5089	31920	Lab Gen Purp	16646		73	Not Surveyed - No Water
5090	42240	Fixed Ammo Mag	945		48	Not Surveyed - No Water
5091	37110	Range Facs		Vacant	60	Not Surveyed - No Water
5092	42240	Fixed Ammo Mag	945		48	Not Surveyed - No Water
5093	44270	Gen Storehouse	3200		60	Not Surveyed - No Water
5094	42215	High Explo Mag	945		48	Not Surveyed - No Water
5095	42215	High Explo Mag	567		42	Not Surveyed - No Water
5096	42215	High Explo Mag	81		42	Not Surveyed - No Water
5097	44240	Inflam Mat Sths	420		62	Not Surveyed - No Water
5098	31920	Lab Gen Purp	1260	Vacant	42	Not Surveyed - No Water
5099	44220	Gen Purpse Whse	2400		59	Not Surveyed - No Water
7300	87150	Retaining Walls		770 Lf	66	Not Surveyed - No Water
7302	14970	Ld & Unld Docks		1 Ea	59	Not Surveyed - No Water
7304	44250	Ug Storage Fac	120		62	Not Surveyed - No Water
7307	85230	Foot Bridges		124.45 SY	70	Not Surveyed - No Water
7308	44280	Open Warehouse	768			Not Surveyed - No Water
7309	44240	Inflam Mat Sths	576		84	Not Surveyed - No Water
7310	44270	Gen Storehouse	58		62	Not Surveyed - No Water
7311	81320	Substation		9500 KV	42	Not Surveyed - No Water
7312	75052	Bndstnd & Pavil		1 Se		Not Surveyed - No Water
7318	89020	Comp Air Plant		750 Hp	83	Not Surveyed - No Water
7322	44222	Stg Shed G Purp	518		64	Not Surveyed - No Water
7325	44222	Stg Shed G Purp			82	Not Surveyed - No Water

## 2 METHODS AND APPROACH

FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.

Table 2.1.3.1 Fort Belvoir Real Property Listing FACILITIES NOT SURVEYED DUE TO NO WATER SERVICES						
FAC NO.	CAT CODE	DESIGNATION	SQ FTG	SEC UNIT	YR CNST	COMMENTS
7326	44240	Inflam Mat Sths	350		59	Not Surveyed - No Water
7327	12450	Veh Fuel Str		1000 Ga	64	Not Surveyed - No Water
7328	44240	Inflam Mat Sths	382		68	Not Surveyed - No Water
7329	44240	Inflam Mat Sths	100		81	Not Surveyed - No Water
7331	85230	Foot Bridges		13 SY		Not Surveyed - No Water
7332	86070	Rr Coal Trestle		140 Lf	48	Not Surveyed - No Water
7334	81160	Standby Generat	600	30 KV	80	Not Surveyed - No Water
7336	83230	Sewage Pump		145 KG	62	Not Surveyed - No Water
7337	81260	Distribut Xfmr		187.5 KV	41	Not Surveyed - No Water
7339	15120	Berthing Pier		481 SY	65	Not Surveyed - No Water
7340	16310	Mooring Dolphin		8 Ea	65	Not Surveyed - No Water
7342	81360	Transformers		23 KV	74	Not Surveyed - No Water
7350	83230	Sewage Pump		290 KG	62	Not Surveyed - No Water
7351	81160	Standby Generat		45 KV	80	Not Surveyed - No Water
7354	31920	Lab Gen Purp	180		83	Not Surveyed - No Water
7356	44240	Inflam Mat Sths	148		66	Not Surveyed - No Water
7357	44240	Inflam Mat Sths	350		74	Not Surveyed - No Water
7362	44240	Inflam Mat Sths	350		77	Not Surveyed - No Water
7363	81160	Standby Generat	1050	30 KV	80	Not Surveyed - No Water
7364	44240	Inflam Mat Sths	350		58	Not Surveyed - No Water
7365	44240	Inflam Mat Sths	350			Not Surveyed - No Water
7367	44240	Inflam Mat Sths	120		62	Not Surveyed - No Water
7368	85230	Foot Bridges		19.45 SY		Not Surveyed - No Water
7369	85230	Foot Bridges		2.67 SY		Not Surveyed - No Water
7370	85230	Foot Bridges		9.78 SY	75	Not Surveyed - No Water
7373	87230	Sentry Station	90		60	Not Surveyed - No Water
7377	44240	Inflam Mat Sths	350		62	Not Surveyed - No Water
7378	15430	Sea Walls		1409 Lf	65	Not Surveyed - No Water
7382	84141	Pump Sta	74	.7 KG	42	Not Surveyed - No Water
7383	83230	Sewage Pump		KG	52	Not Surveyed - No Water
7386	84141	Pump Sta	600		50	Not Surveyed - No Water
7391	45210	Open Str Area		17700 SY	60	Not Surveyed - No Water
7395	87230	Sentry Station	150		62	Not Surveyed - No Water
7397	75052	Bndstnd & Pavil		1 Se		Not Surveyed - No Water
7398	75013	Volley Ball Ct		Ea	83	Not Surveyed - No Water
7399	44270	Gen Storehouse	350		74	Not Surveyed - No Water

## 2 METHODS AND APPROACH

FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.

<p>Table 2.1.3.2 Fort Belvoir Real Property Listing NON-FAMILY HOUSING FACILITIES ABANDONED OR UNOCCUPIED</p>						
FACILITY NO.	CAT CODE	DESIGNATION	SQ FTG	SEC UNT	YR CNST	COMMENTS
83	13170	Receiver Bldg	625	Vacant	37	Vacant
172	74032	Guest House	2237	1 Pn	49	Building Locked; Inaccessible
192	81150	Unterup Sys Fac	420			Building Locked; Inaccessible
193	61050	Admin Gen Purp/adp	13314	5 Pn	34	Building Locked; Inaccessible
203	72111	Enl Bk w/o Din - Admin	24056	Vacant	28	Building Locked; Inaccessible
213	72111	Enl Bk W/o Din - Vac	30234	100 Pn	40	Building Locked; Inaccessible
231	72210	Enl Pers Dine	12974	120 Pn	68	Building Locked; Inaccessible
236	75030	Outdr Swim Pool		1 Ea	45	Closed Due to Weather
269	61011	Post Hq Bldg	29799		35	Under Renovation
292	17120	Gen Inst Bldg	1596		68	Under Construction
327	31920	Lab Gen Purp	21278	Vacant	42	Vacant
338	61050	Admin Gen Purp	1480	Vacant	42	Vacant
341	31920	Lab Gen Purp	2240	Vacant	62	Vacant
358	61021	Engr Admin Bldg	23814	Vacant	64	Vacant
359	31740	Elctron Eqp Fac	5880	Vacant	59	Vacant
366	31920	Lab Gen Purp	2160	Vacant	53	Vacant
372	17120	Gen Inst Bldg	10392	Vacant	60	Vacant
383	31920	Lab Gen Purp	21750		50	No One Home
384	31740	Elctron Eqp Fac	420	Vacant	64	Vacant
390	31920	Lab Gen Purp	3000	Vacant	51	Vacant
677	21410	Veh Mnt Sh Org	8400		83	Building Locked; Inaccessible
766	44275	Fe Storehouse/admin	35100			Building Locked; Inaccessible
767	44220	Gen Purp Whse/shop	113550			Building Locked; Inaccessible
768	44220	Gen Purp Whse	16300			Building Locked; Inaccessible
805	72111	Enl Bks w/o Din	17948	72 Pn	59	Building Locked; Inaccessible
1023	74028	Phys Fitness Ctr	7439		53	Building Locked; Inaccessible

## 2 METHODS AND APPROACH

FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.

Table 2.1.3.2 Fort Belvoir Real Property Listing NON-FAMILY HOUSING FACILITIES ABANDONED OR UNOCCUPIED						
FACILITY NO.	CAT CODE	DESIGNATION	SQ FTG	SEC UNT	YR CNST	COMMENTS
1418	17120	Gen Inst Bldg	23512		45	Building Locked; Inaccessible
1440	17130	Appl Inst Bldg	14521		74	Building Locked; Inaccessible
1457	14114	Cidc Fld Op Bldg	6270			Building Locked; Inaccessible
1498	61050	Admin Gen Purp	4160	Vacant	66	Under Renovation
1499	61050	Admin Gen Purp	4160	Vacant	66	Vacant
1745	74014	Child Supp Ctr	25076			Building Locked; Inaccessible
1945	21920	Fe Facility	410			Building Locked; Inaccessible
2120	74076	Thtr w/Dress Rm	8452	50 Se	75	Building Locked; Inaccessible
2430	74072	Indr Swim Pool	2176		79	Closed Due to Weather
2436	17120	Gen Inst Bldg	3200		67	Building Locked; Inaccessible
2444	61050	Admin Gen Purp	229913		89	Building Locked; Inaccessible
2466	74069	Recreation Bldg	1315	Vacant		Vacant
2916	73075	Public Toilet	278	Vacant		Vacant
2917	73075	Public Toilet	278	Vacant		Vacant
2918	73075	Public Toilet	278	Vacant		Vacant
2919	73075	Public Toilet	278	Vacant		Vacant
2921	74031	Golf Course Mnt	112	Vacant		Vacant
2924	74031	Golf Course Mnt	96	Vacant		Vacant
3066	17120	Gen Inst Bldg	3220	Vacant	66	Vacant
3086	17120	Gen Inst Bldg	600	Vacant	58	Vacant
3087	17120	Gen Inst Bldg	600	Vacant	58	Vacant
3153	21120	Ac Comp Mnt Shp	1233		78	Building Locked; Inaccessible
5043	31740	Elctron Eqp Fac	15000			Building Locked; Inaccessible

## 2 METHODS AND APPROACH

FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.

<p>Table 2.1.3.3 Fort Belvoir Real Property Listing NON-FAMILY HOUSING FACILITIES SCHEDULED FOR DEMOLITION</p>						
FAC NO.	CAT CODE	DESIGNATION	SQ FTG	SEC UNT	YR CNST	DEMO YR
181	12311	Gas Stn w/o Bdg		5 OI	41	96
346	44270	Gen Storehouse	720		45	96
379	31920	Lab Gen Purp	1192	Vacant	65	97
400	13110	Cable House	1478		72	91
447	84142	Wtr Pump Sta Bd	193		43	93
498	61050	Admin Gen Purp	9575		44	99
645	75070	Boat Pier Recr		1 Ea	49	98
681	83114	Sew/w Tr Pl Bdg	947	50 KG	34	91
688	73075	Public Toilet	200		55	98
697	75050	Outdoor Theater		200 Se	74	98
698	83231	Sew Pump Sta Bdg	120		79	98
699	74047	Open Din NCO	1324		55	98
715	21410	Veh Mnt Sh Org	3130		41	96
739	44275	Fe Storehouse	3525	Vacant	41	95
741	21920	Fe Facility	10315	Vacant	44	95
744	44270	Gen Storehouse	280	Vacant		95
745	21920	Fe Facility	10232	Vacant	43	95
745	82116	Heat Pl Bldg	474	Vacant	43	95
746	44261	Lum & P Shed Fe	960	Vacant	43	95
772	44270	Gen Storehouse	5560		47	99
773	74069	Recreation Bldg	36231		53	2000
778	14131	Ops Gen Purp	16000	Vacant	55	2000
1030	61025	Med Admin Bldg	8040	Vacant	40	95
1089	83320	Recycling Fac	8060		38	96
1104	87240	Kennel	4720		48	2000
1106	21470	Oil Sto Bldg	54		61	98
1107	44270	Gen Storehouse	2037		59	98
1109	44270	Gen Storehouse	4474		58	98
1110	44240	Inflam Mat Sths	1650		61	98
1112	44240	Inflam Mat Sths	280		18	98

## 2 METHODS AND APPROACH

FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.

<p>Table 2.1.3.3 Fort Belvoir Real Property Listing NON-FAMILY HOUSING FACILITIES SCHEDULED FOR DEMOLITION</p>						
FAC NO.	CAT CODE	DESIGNATION	SQ FTG	SEC UNT	YR CNST	DEMO YR
1113	44275	Fe Storehouse	7194	Vacant	38	98
1117	44220	Gen Purp Whse	3116		Demo	91
1123	44240	Inflam Mat Sths	496		42	2000
1125	12310	Gas Stn Bldg	169		43	96
1131	61028	Pm Admin Bldg	13800		43	99
1138	74069	Recreation Bldg	3087		42	96
1169	61050	Admin Gen Purp	4440		44	99
1170	61050	Admin Gen Purp	4636		44	99
1171	61050	Admin Gen Purp	4477		44	99
1193	74078	Thrift Shop	15530		42	96
1426	17120	Gen Inst Bldg	4108		57	95
1427	17120	Gen Inst Bldg	4108		57	95
1428	17120	Gen Inst Bldg	4305		57	95
1430	44270	Gen Storehouse	4305		57	95
1431	44270	Gen Storehouse	4108		57	95
1460	14183	Bn HQ Bldg	3663		41	2000
1475	61050	Admin Gen Purp	10768		43	99
1481	17120	Gen Inst Bldg	4920		40	99
1485	17120	Gen Inst Bldg	4080		42	99
1486	17120	Gen Inst Bldg	4440		42	99
1487	74022	Skill Dev Cen	4440		42	99
1488	74022	Skill Dev Cen	4484		42	99
1489	81321	Substation Bldg	105		55	91
1492	87230	Sentry Station	72		74	2000
1494	74030	Golf Club House	1824		42	97
1696	74022	Skill Dev Cen	3830		43	98
1697	74026	Entr Workshop	2188		62	98
1802	73010	Fire Station	3876		46	97
1805	61022	Ord Adm Bldg	2250		40	97
1806	61022	Ord Adm Bldg	1575		40	97
1810	74028	Phys Fit Center	24585		47	96

## 2 METHODS AND APPROACH

FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.

<p>Table 2.1.3.3 Fort Belvoir Real Property Listing NON-FAMILY HOUSING FACILITIES SCHEDULED FOR DEMOLITION</p>						
FAC NO.	CAT CODE	DESIGNATION	SQ FTG	SEC UNT	YR CNST	DEMO YR
1812	74086	Handball Ct Id	12220	25 Pn	40	95
1813	61050	Admin Gen Purp	2964		41	99
1818	61050	Admin Gen Purp	4800		41	97
1819	61050	Admin Gen Purp	4800		41	97
1826	73028	Drug Abuse Ctr	3663		41	97
1829	14183	Bn HQ Bldg	1612		40	97
1831	73047	Depn KGrtn Sch	2860		41	99
1834	14183	Bn HQ Bldg	1638		40	2000
1835	61050	Admin Gen Purp	16085		41	99
1836	61050	Admin Gen Purp	3663		41	99
1837	61050	Admin Gen Purp	2250		40	99
1901	14185	Co HQ Bldg	3185		40	99
1902	14184	Gp HQ Bldg	11200		45	99
1903	61050	Admin Gen Purp	4897		44	99
1907	61021	Engr Admin Bldg	3663		41	99
1908	61050	Admin Gen Purp	4830		41	97
1909	72390	Other	300		42	97
1911	14183	Bn Hq Bldg	3150		40	99
1912	14184	Gp Hq Bldg	1215		42	99
1915	61050	Admin Gen Purp	2340		40	99
1916	75090	Other	1620		40	99
1917	61050	Admin Gen Purp	2263	25 Pn	40	98
1918	61050	Admin Gen Purp	1575		40	97
1919	61050	Admin Gen Purp	1600		40	97
1920	72330	Adm & Sup Bldg	2990		40	99
1921	14130	Sig Photo Lab	1575		40	97
1922	14185	Co HQ Bldg	1575		40	97
1923	61050	Admin Gen Purp	4920		41	97
1924	61050	Admin Gen Purp	4800		41	97
1925	61050	Admin Gen Purp	4800		41	2000
1926	61050	Admin Gen Purp	4800		41	2000

## 2 METHODS AND APPROACH

FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.

<p>Table 2.1.3.3 Fort Belvoir Real Property Listing NON-FAMILY HOUSING FACILITIES SCHEDULED FOR DEMOLITION</p>						
FAC NO.	CAT CODE	DESIGNATION	SQ FTG	SEC UNT	YR CNST	DEMO YR
1927	61050	Admin Gen Purp	4980	3 Pn	41	2000
1928	61050	Admin Gen Purp	4920		41	2000
1929	61050	Admin Gen Purp	4920		41	2000
1930	61050	Admin Gen Purp	4920		41	2000
1931	73072	Po Branch	3380		40	2000
1934	74022	Skill Dev Cen	3663		41	99
1935	87235	Dispatch Bldg	825		40	99
1937	72390	Other	224		42	99
1938	21410	Veh Mnt Sh Org	3182		40	99
1939	21410	Veh Mnt Sh Org	3108		40	99
1960	14114	Cidc Fld Op Bldg	3663	Vacant	41	2000
1961	61040	Civ Pers Bldg	1600		40	2000
1962	61050	Admin Gen Purp	7560		41	2000
1964	44270	Gen Storehouse	1575		40	95
1966	72335	Bn Storage Bldg	3663		41	2000
2201	61021	Engr Adm Bldg	1300		40	95
2202	61040	Civ Pers Bldg	4830		41	95
2203	44270	Gen Storehouse	4830		41	95
2208	61040	Civ Pers Bldg	4830		41	95
2209	61040	Civ Pers Bldg	4830		41	95
2211	44270	Gen Storehouse	4830	Vacant	41	95
2217	61040	Civ Pers Bldg	4830		43	95
2220	61040	Civ Pers Bldg - Vac	4830		41	95
2223	61041	Mil Pers Bldg	4830		41	2000
2225	72390	Other	1336		40	95
2226	17140	Army Res Center	4830		41	2000
2227	72111	Enl Bk W/o Din	4830		41	2000
2232	61041	Mil Pers Bldg	4830		41	2000
2233	61050	Admin Gen Purp	4830		41	2000
2234	61041	Mil Pers Bldg	4830		41	2000
2235	17140	Army Res Center	4830	4 Pn	41	2000



## 2 METHODS AND APPROACH

FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.

<p>Table 2.1.3.3 Fort Belvoir Real Property Listing NON-FAMILY HOUSING FACILITIES SCHEDULED FOR DEMOLITION</p>						
FAC NO.	CAT CODE	DESIGNATION	SQ FTG	SEC UNT	YR CNST	DEMO YR
2236	61050	Admin Gen Purp	1336	Vacant	40	95
2237	72390	Other	1336		40	95
2238	44290	Other	4830		41	2000
2239	61050	Admin Gen Purp - Vac	4830	Vacant	41	2000
2241	72111	Enl Bk W/o Din - Vac	4830	Vacant	41	2000
2244	72111	Enl Bk W/o Din - Vac	4830	Vacant	41	2000
2245	72111	Enl Bk W/o Din - Vac	4830	Vacant	41	2000
2246	72111	Enl Bk W/o Din	4830	25 Pn	41	2000
2247	61050	Admin Gen Purp	4830	41 Pn	41	2000
2251	72111	Enl Bk W/o Din - Vac	4830	Vacant	41	2000
2262	72335	Bn Storage Bldg	2795		42	98
2263	44240	Inflam Mat Sths	224	Vacant	42	98
2276	72335	Bn Storage Bldg	1630		40	98
2283	61050	Admin Gen Purp	6420		41	99
2284	61050	Admin Gen Purp	7392	Vacant	41	95
2402	72110	Enl Bk w/ Din	4830	44 Pn	40	95
2411	72110	Enl Bk w/ Din	4830	44 Pn	40	95
2425	61050	Admin Gen Purp	4720		42	95
2458	17120	Gen Inst Bldg	12299		53	95
2477	44270	Gen Storehouse	24272		47	99
2484	72321	Det Latrine Bdg	300		67	96
2903	44270	Gen Storehouse	2178		44	99
5009	21410	Veh Mnt Sh Org	7631	Vacant	43	96
5037	44270	Gen Storehouse	4000	Vacant	47	96
7306	44270	Gen Storehouse	300		46	96

## 2 METHODS AND APPROACH

FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.

<p>Table 2.1.3.4 Fort Belvoir Real Property Listing POST FACILITIES: NON-FAMILY HOUSING FACILITIES AT FORT BELVOIR NOT IN SCOPE FOR THIS SURVEY</p>							
FAC NO.	CAT CODE	DESIGNATION	SQ FTG	SEC UNT	YR CNST	DEMO YR	COMMENTS
950	73048	Depn Grade Sch	22130	295 Pn	60		Not in Scope for Survey
1017	73048	Depn Grade Sch	43352	398 Pn	57		Not in Scope for Survey
1741	73048	Depn Grade Sch	30615	296 Pn	60		Not in Scope for Survey
2580	44220	Gen Purp Whse	96802		75	HECSA	Not in Scope for Survey
2581	31090	Other	3648		75	HECSA	Not in Scope for Survey
2582	44280	Open Warehouse	6000		75	HECSA	Not in Scope for Survey
2583	21885	Mnt Sh Gen Purp	1800		75	HECSA	Not in Scope for Survey
2584	44280	Open Warehouse	7200		75	HECSA	Not in Scope for Survey
2585	21420	Veh Mnt Sh Ds	7200		75	HECSA	Not in Scope for Survey
2586	12311	Gas Sta W/o Bldg	120		75	HECSA	Not in Scope for Survey
2587	44150	Inflam Mat Sths	120		75	HECSA	Not in Scope for Survey
2588	14970	Ld & Unld Docks		1 Ea		HECSA	Not in Scope for Survey
2590	17150	Bn Classrooms	1414		63	HECSA	Not in Scope for Survey
2591	61050	Admin Gen Purp	7117			HECSA	Not in Scope for Survey
2592	31090	Other	169000		74	HECSA	Not in Scope for Survey
2593	61050	Admin Gen Purp	94200		73	HECSA	Not in Scope for Survey
2594	61050	Admin Gen Purp	52449		73	HECSA	Not in Scope for Survey
2595	44220	Gen Purp Whse	4750		65	HECSA	Not in Scope for Survey
2800	31920	Lab Gen Purp	605420		75	DCEETA	Not in Scope for Survey
2801	81320	Substation		1 KV	75	DCEETA	Not in Scope for Survey
2802	31920	Lab Gen Purp	25534		75	DCEETA	Not in Scope for Survey
2803	12470	Htg Fuel Str		25000 Ga	75	DCEETA	Not in Scope for Survey
2804	31920	Lab Gen Purp	2100			DCEETA	Not in Scope for Survey
2805	82631	Evap Cool Equip		1 Cm	75	DCEETA	Not in Scope for Survey
2807	31920	Lab Gen Purp	41442		75	DCEETA	Not in Scope for Survey

## 2 METHODS AND APPROACH

FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.

Table 2.1.3.4 Fort Belvoir Real Property Listing POST FACILITIES: NON-FAMILY HOUSING FACILITIES AT FORT BELVOIR NOT IN SCOPE FOR THIS SURVEY							
FAC NO.	CAT CODE	DESIGNATION	SQ FTG	SEC UNT	YR CNST	DEMO YR	COMMENTS
2809	31920	Lab Gen Purp	2675		76	DCEETA	Not in Scope for Survey
2810	14940	Radar Tower		1 Ea	76	DCEETA	Not in Scope for Survey
2812	87230	Sentry Station	200		75	DCEETA	Not in Scope for Survey
2813	44190	Other	175450			DCEETA	Not in Scope for Survey
2820	31920	Lab Gen Purp			75	DCEETA	Not in Scope for Survey
2821	82631	Evap Cool Equip		1 Cm		DCEETA	Not in Scope for Survey
2822	13210	Antenna Tower		1 Ea	75	DCEETA	Not in Scope for Survey
2825	31920	Lab Gen Purp	300		75	DCEETA	Not in Scope for Survey
2826	44240	Inflam Mat Sths	2484		76	DCEETA	Not in Scope for Survey
2827	44220	Gen Purpose Whse	39638		76	DCEETA	Not in Scope for Survey
2828	45210	Open Str Area		7400 SY		DCEETA	Not in Scope for Survey
2829	31920	Lab Gen Purp	11450		78	DCEETA	Not in Scope for Survey
2830	12311	Gas Sta w/o Bldg		1 Ol		DCEETA	Not in Scope for Survey
2840	13210	Antenna Tower		1 Ea	75	DCEETA	Not in Scope for Survey
2844	87230	Sentry Station	50			DCEETA	Not in Scope for Survey
2845	31920	Lab Gen Purp	3600		74	DCEETA	Not in Scope for Survey
2846	44270	Gen Storehouse	414		74	DCEETA	Not in Scope for Survey
2850	81320	Substation		1 KV		DCEETA	Not in Scope for Survey
2851	82615	Ac Plant Bldg	12000			DCEETA	Not in Scope for Survey
2854	82631	Evap Cool Equip		1 Cm		DCEETA	Not in Scope for Survey
2855	44222	Stg Shed G Purp	8349			DCEETA	Not in Scope for Survey
2856	31920	Lab Gen Purp	12113			DCEETA	Not in Scope for Survey
2857	81160	Standby Generat	36270			DCEETA	Not in Scope for Survey
2865	13210	Antenna Tower		1 Ea		DCEETA	Not in Scope for Survey
2866	13210	Antenna Tower		1 Ea		DCEETA	Not in Scope for Survey

## 2 METHODS AND APPROACH

FY955 WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.

Table 2.1.3.5 Fort Belvoir Real Property Listing POST FACILITIES: NON-APPROPRIATED FUNDS-AAFES							
FAC NO.	CAT CODE	DESIGNATION	SQ FTG	SEC UNT	YR CNST	DEMO YR	COMMENTS
238	74056	Exch Svc Outlet	5188	Vacant	58		Non - Appropriated Fund Activity
238	74056	Exch Svc Outlet	5029		58		Non - Appropriated Fund Activity
321	74051	Exchange Cafe	6609		42		Non - Appropriated Fund Activity
705	74055	Exch Warehouse	8174		44		Non - Appropriated Fund Activity
706	74055	Exch Warehouse	9180		46		Non - Appropriated Fund Activity
1139	74055	Exch Warehouse	9516		17		Non - Appropriated Fund Activity
1146	74052	Exch Svc Sta	6916		42		Non - Appropriated Fund Activity
1150	61030	Exch Admin Bldg	3445		34		
1153	74056	Exch Svc Outlet	4496		46		Non - Appropriated Fund Activity
1155	74056	Exch Svc Outlet	12795		80		Non - Appropriated Fund Activity
1185	74056	Exch Svc Outlet	2704		69		Non - Appropriated Fund Activity
1186	74056	Exch Svc Outlet	4080		69		Non - Appropriated Fund Activity
1187	74056	Exch Svc Outlet	1400		69	98	Non - Appropriated Fund Activity
1188	74057	Exch Sp Spt Fac	7605		68		Non - Appropriated Fund Activity
1189	74053	Exch Main Retl	74348		69		Non - Appropriated Fund Activity
1196	74056	Exch Svc Outlet	2600		64		Non - Appropriated Fund Activity
1197	74052	Exch Svc Sta	3614		64		Non - Appropriated Fund Activity
1803	74052	Exch Svc Sta	504		41	99	Non - Appropriated Fund Activity
2303	74053	Exch Main Retl	155780				Non - Appropriated Fund Activity
3137	74051	Exchange Cafe	1845		55		Non - Appropriated Fund Activity

## 2 METHODS AND APPROACH

FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.

### 2.2 CALCULATIONS

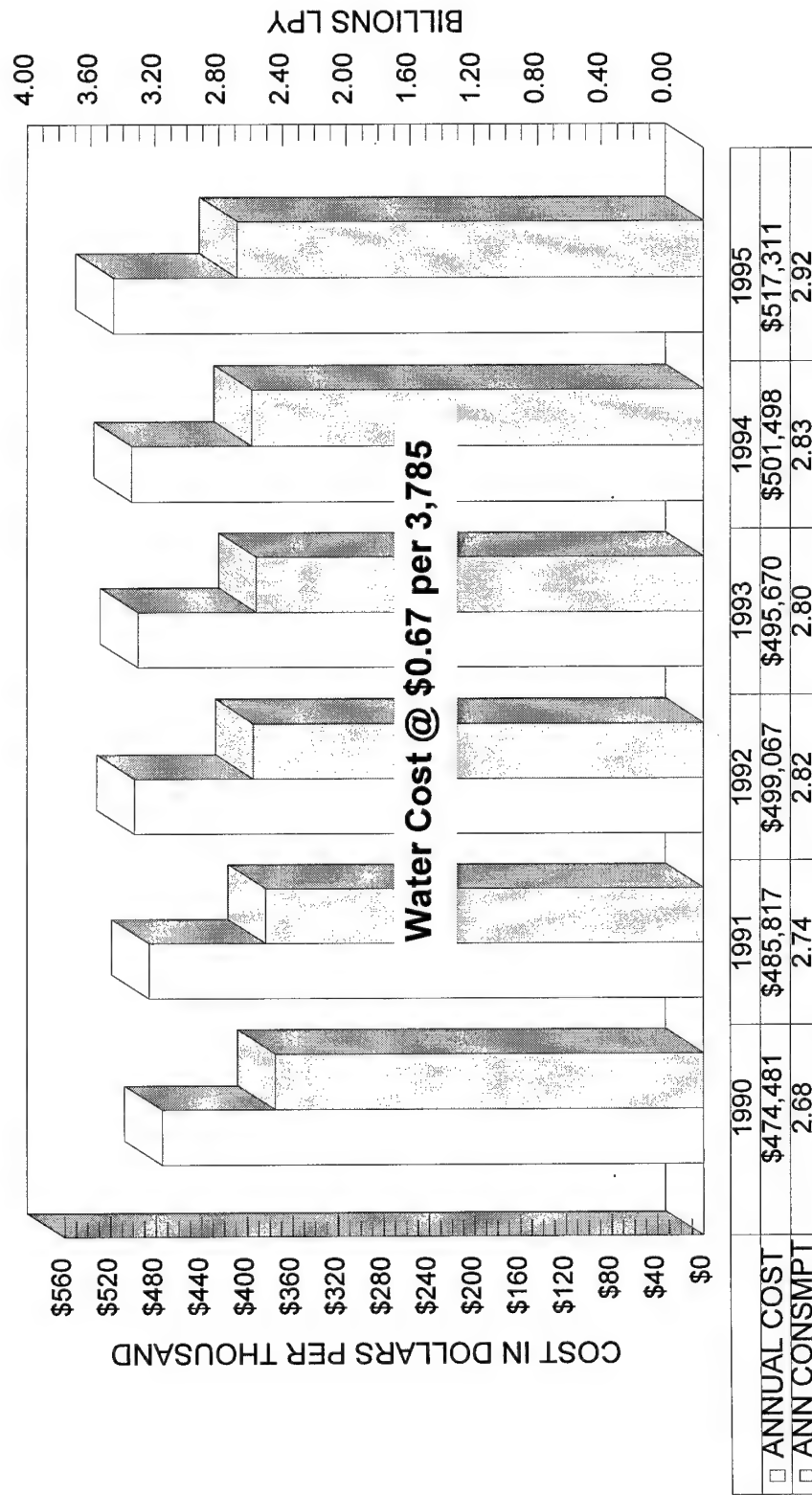
Water and energy calculations were performed using computerized techniques. Due to the large volume of calculations to be performed, standardized spreadsheets and procedures were developed. This assured consistent results and uniformity of quality in all of the calculations performed.

#### 2.2.1 Baseline Water and Energy Consumption

Baseline water, maintenance and repair costs/savings are included in the calculations for those respective WCOs where it is considered they would cause a change in current practice. The annual potable water usage at Fort Belvoir from July 1994 through April 1995 was 2,522,952,309 liters (666,564,000 gallons). The volume of sewage treated was 1,262,781,983 liters (333,627,000 gallons). The net volumetric difference between potable water produced and sewage treated is 1,260,170,326 liters (332,937,000 gallons) more of potable water produced. Factors that affect the net differences are irrigation, evaporation, and substantial leakage from the water distribution system piping at a rate of 483,424,678 liters per year (127,720,800 gallons per year). Water consumption has increased at Fort Belvoir from 2.65 billion liters per year (708.2 million gallons per year) in 1990 to 2.92 billion liters per year (772.1 million gallons per year) in 1995 as illustrated in *Figure 2.2.1*. This represents a ten percent increase in water consumption over the past six years due to growth at Fort Belvoir during the same time period. A significant reduction will occur immediately if the projects recommended in this report are implemented. Also, if the water conservation methods outlined in this report are utilized for future growth at Fort Belvoir, continued savings will result.

The annual costs shown in *Figure 2.2.1* were calculated based on Fairfax County Water Authority's rate of \$0.67/3,785 liters (kgallons). These figures do not include the demand charge or future storage charges. The calculation is as follows:

Figure 2.2.1  
**FORT BELVOIR ANNUAL WATER CONSUMPTION - 1990 THRU 1995**



## 2 METHODS AND APPROACH

FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.

$$\begin{aligned}\text{Cost} &= \$0.67/3,785 \text{ liters} \\ &= \underline{\$0.67 \times 2,680,465,556 \text{ LPY}} \\ &\quad 3,785 \text{ liters} \\ &= \$474,481.00\end{aligned}$$

$$\begin{aligned}\text{Cost} &= \$0.67/3,785 \text{ liters} \\ &= \underline{\$0.67 \times 2,744,504,164 \text{ LPY}} \\ &\quad 3,785 \text{ liters} \\ &= \$485,817.00\end{aligned}$$

$$\begin{aligned}\text{Cost} &= \$0.67/3,785 \text{ liters} \\ &= \underline{\$0.67 \times 2,819,356,548 \text{ LPY}} \\ &\quad 3,785 \text{ liters} \\ &= \$499,067.00\end{aligned}$$

$$\begin{aligned}\text{Cost} &= \$0.67/3,785 \text{ liters} \\ &= \underline{\$0.67 \times 2,800,170,326 \text{ LPY}} \\ &\quad 3,785 \text{ liters} \\ &= \$495,670.00\end{aligned}$$

$$\begin{aligned}\text{Cost} &= \$0.67/3,785 \text{ liters} \\ &= \underline{\$0.67 \times 2,833,088,569 \text{ LPY}} \\ &\quad 3,785 \text{ liters} \\ &= \$501,498.00\end{aligned}$$

$$\begin{aligned}\text{Cost} &= \$0.67/3,785 \text{ liters} \\ &= \underline{\$0.67 \times 2,922,422,407 \text{ LPY}} \\ &\quad 3,785 \text{ liters} \\ &= \$517,311.00\end{aligned}$$

The following sections will describe the method for calculating the baseline water and energy consumption for each of the WCOs.

### 2.2.1.1 Calculation Methods

The baseline water and energy consumption for each WCO was calculated using a LOTUS123 spreadsheet. The water consumption was modeled using DOE and FEMP standards, field measurements and population data at Fort Belvoir. The information necessary to calculate the baseline includes the following:

1. Category Codes
2. Square Footage and Age
3. Occupancy Schedule
4. Plumbing Fixture Count
5. Water Flow Measurements
6. Linear Sources

The above information was obtained during the field survey.

## 2 METHODS AND APPROACH

FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.

### 2.2.2 Sample Water Conservation Opportunity Calculations

The following discussion describes the calculations in general terms performed by Systems Corp for WCO 1 on every non-family housing facility at Fort Belvoir. The calculations performed for the other WCOs are similar to these with minor exceptions.

The "calculations" for each WCO primarily occur on Page 2 of 2 of the calculation set. The "calculations" result from the various inputs that appear on Page 1 of 2 in the calculation set.

#### 2.2.2.1 Sample Calculations

"Annual Water Saving" (LPY) = {(Existing Fixture Flow (LPM) - Retrofitted Fixture Flow (LPM)) x 60 min/hr} x Usage (Hrs/Yr/Fix) x (# of Fixtures) where the following definitions apply:

*Annual Water Savings* = Estimated quantity of water saved on an annual basis by implementing the WCO being evaluated to the number of fixtures identified to be present in the respective facility. Value shown is in units of liters per year (LPY).

*Existing Fixture Flow* = As determined during field survey in liters per minute (LPM).

*Retrofitted Fixture Flow* - fixture flow after WCO being evaluated has been implemented (in this case a spring loaded lavatory faucet installed in place of existing lavatory faucet).

*60 Min/Hr* = Constant applied to convert liters per minute flow to flow in liters per hour (LPM to LPH).

*Usage (Hrs/Yr/Fix)* = Estimated number of hours per year that each fixture in the facility being evaluated (i.e., lavatory faucet) will flow water assuming each lavatory faucet runs 4 minutes per day per person occupying the facility.

*Number of Fixtures* = Quantity of fixtures found to be present in the identified facility during the field survey and applicable to the WCO.

Once the Annual Water Savings have been determined, the "Water Dollar Savings" can be determined from the following:



## 2 METHODS AND APPROACH

FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.

*WATER Dollar Savings* (\$) = (Annual Water Savings (LPY)/1,000 Liters/KL) x \$/KL where the \$/KL is as shown on Page 2 of 2 at the top. It is the sum of the Water \$/KL + the Sewer \$/KL paid by Fort Belvoir.

The "*Annual Energy Savings (Gas MWH)*" is determined as follows:

*"Annual Energy Savings (Gas MWH)* = ((Annual Water Savings (LPY) x (.25) x (2.172 Btu/Liter F) x (50 F) / (.75)) / (3,412,000 Btu/MWH) with the following definitions.

*Annual Water Saving (LPY)* = as previously defined.

.25 = Standard assumption that one fourth of the water that flows through the faucet is heated.

2.172 Btu/Liter F = Constant to convert the annual water savings in LPY to Btu/Yr F.

50 F = Assumption that the water is heated 50 degrees Fahrenheit (i.e., 60°F to 110°F) by the water heater before it is mixed with cold water at the faucet.

.75 = Assumption that the gas water heater being used to heat the water is 75% efficient.

3,412,000 Btu/MWH = Constant to convert the natural gas consumption in Btu's (British Thermal Units) to Megawatt Hours (MWH).

The "*Total Dollar Savings*" = WATER Dollar Savings + (GAS MWH x Gas Rate (\$/MWH) where,

*WATER Dollar Savings* = as previously defined;

*GAS MWH* = as previously defined;

*Gas Rate (\$/MWH)* = determined from actual billing data provided by Fort Belvoir.

The "*Total Dollars Invested*" is simply the construction cost as determined for the number of fixtures involved from "Means" cost estimating program. This cost does not include SIOH or design cost.

## 2 METHODS AND APPROACH

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FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.

### 2.2.3 WCO Water and Energy Consumption

The following sections describe how the water and energy savings for each WCO was calculated.

#### 2.2.3.1 WCO Water and Energy Consumption: WCO-1 Spring Loaded Faucets

The water and energy savings are calculated using the differential between the measured existing flow rate and the new flow rate. The new flow rate is based upon a thirty-second duration of flow when activated. DOE and FEMP standards were used to estimate frequency of demand.

Per manufacturer's recommendations, an annual maintenance and repair cost of \$19.72 per faucet has been subtracted from the estimated annual water savings for each faucet in each building under consideration. This accounts for replacing the faucet cartridge annually, as recommended, and is a maintenance and repair item that currently does not occur at Fort Belvoir as these faucets would be new following completion of this project.

#### 2.2.3.2 WCO Water and Energy Consumption: WCO-2 Faucet Aerators

The water and energy savings are calculated using the differential between the measured existing flow rate and the new flow rate. The new flow rate was obtained from manufacturer data. The new flow rate is fifty percent of the existing measured flowrate. DOE and FEMP standards were used to calculate daily consumption. Building occupancy data was used in the calculations. No maintenance and repair costs/savings are included in this WCO since faucet aerators currently exist. Faucet aerators require little to no maintenance. A percentage of faucet aerators needs to be replaced periodically due to vandalism but, this should be occurring now. Therefore this cost, for the purposes of this WCO, remains unchanged and would exist whether this work was accomplished or not.

#### 2.2.3.3 WCO Water and Energy Consumption: WCO-2FH Faucet Aerators (Family Housing)

The water and energy savings are calculated using the differential between the measured existing flow rate and the new flow rate. The new flow rate was obtained from manufacturer data; the new flow rate is fifty percent of the existing measured flow rate. DOE and FEMP standards were used to calculate daily consumption. Family housing population data was used in the calculations. No

## 2 METHODS AND APPROACH

FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.

maintenance and repair costs/savings are included as they are considered to be unchanged from current practice. See WCO 2 for further discussion.

### 2.2.3.4 WCO Water Consumption: WCO-3 Flush Valve Retrofits for Water Closets

The water savings are calculated using the differential between the existing consumption rate and the new consumption rate. The existing flush valve consumption rate of 17 liters per flush (4.5 gallons per flush) was determined in the field. EPACT requires 6.0 LPF (1.6 GPF); however, the water closets installed at Fort Belvoir are designed for a 17.0 LPF (4.5 GPF). The manufacturer's representative for Sloan Flush Valves recommended using a repair kit to reduce the volume of water to no less than 13.2 LPF (3.5 GPF) for a proper flushing cycle. To meet EPACT requirements of 6.0 LPF, the entire water closet would need to be replaced. The cost would reduce the SIR to below the required 1.25 and a simple pay back period of greater than ten years. The new flush valve consumption rate of 13.2 liters per flush (3.5 gallons per flush) is based upon manufacturer's performance data. DOE and FEMP standards were used to estimate frequency of demand and daily consumption. Building occupancy data was used in the calculations. No additional maintenance and repair costs/savings are included in this WCO as current costs were considered to be unaffected by this work.

### 2.2.3.5 WCO Water Consumption: WCO-3FH Water Closet Retrofits - Install Early Closing Flappers (Family Housing)

The water savings are calculated using the differential between the existing consumption rate and the new consumption rate. The existing consumption rate was determined in the field to be 19 liters per flush (5.0 gallons per flush). To meet EPACT requirements of 6.0 LPF (1.69 GPF), the entire water closet would need to be replaced. The cost would cause a reduced SIR and increase the simple pay back period. The new consumption rate was based upon manufacturer's data of an average of 11.35 liters per flush (three gallons per flush) for an average savings of 7.6 LPF (20 GPF). DOE and FEMP standards were used to estimate frequency of demand. Family housing population data was used in the calculations. No maintenance and repair costs/savings, other than replacement in years seven and 14, as recommended, are included in this WCO. Except for scheduled replacement, the annual maintenance and repair costs are considered to remain unchanged.

## 2 METHODS AND APPROACH

FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.

### 2.2.3.6 WCO Water Consumption: WCO3AFH Water Closet Replacements (Family Housing)

The water savings are calculated using the differential between the existing consumption rate and the new consumption rate. The existing consumption rate was determined in the field to be 19 liters per flush (5.0 gallons per flush). The new consumption rate was based upon manufacturer's data of 6.0 liters per flush (1.6 gallons per flush). DOE and FEMP standards were used to estimate frequency of demand. Family housing population data was used in the calculations. No additional maintenance and repair costs/savings are included in this WCO as they are considered to be unchanged from current practice.

### 2.2.3.7 WCO Water Consumption: WCO-4 Flush Valve Retrofits for Urinals

The water savings are calculated using the differential between the existing consumption rate and the new consumption rate. The existing consumption rate of 5.7 liters per flush (1.5 gallons per flush) was measured in the field. The new consumption rate of 3.8 liters per flush (1.0 gallons per flush) is based upon manufacturer's performance data. DOE and FEMP standards were used to estimate frequency of demand. Building occupancy data was used in the calculations. No additional maintenance and repair costs/savings are included in this WCO as current costs are considered to be unaffected by this work.

### 2.2.3.8 WCO Water and Energy Consumption: WCO-13 Water Efficient Equipment Upgrades

The steam loss from failed steam traps was calculated using Napier's Equation and boiler plant operating logs.

$$W = (Pa)/(70)$$

$W$  is the amount of steam in pounds per second.

$P$  is the absolute pressure before passing through the orifice in pounds per square inch.

$a$  is the area of the orifice in square inches.

The orifice size was determined from published manufacturers' data for the respective steam trap. Napier's Law states, "the flow of steam from a higher to lower pressure is proportional to the higher absolute pressure."

## 2 METHODS AND APPROACH

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FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.

Cost estimates were performed utilizing *Means Cost Data* and the *Means for Lotus* software. The Means Cost Data provides information for the materials and labor required to remove and install steam traps. No additional maintenance and repair costs/savings are included in this WCO as current costs are considered to be unaffected by this work.

### 2.2.3.9 WCO Water Consumption: WCO-14 Water Distribution Leak Detection and Repair

The water savings are determined by the amount of leakage discovered during the distribution system leak detection survey. The amount of discounted savings is calculated using the rate of leakage multiplied by Fairfax County's water rates (0.67/1,000 gal.) and the economic life of the repairs of fifteen years. No additional maintenance and repair costs/savings are included in this WCO as current costs are considered to be unaffected by this work.

### 2.2.3.10 WCO Water and Energy Consumption: WCO-16 Sensor Controls for Faucets and Flush Valves

The water and energy savings are calculated using the differential between the measured existing flow rate and the new flow rate. DOE and FEMP standards were used to estimate frequency of demand. No maintenance and repair costs/savings were determined for this WCO as it was rejected following preliminary savings calculations.

## 2.3 WCOs REJECTED AFTER ANALYSIS

WCOs 3AFH and 16 were rejected after completed calculations revealed insufficient savings for each of the rejected WCOs.

### 2.3.1 WCO-3AFH Water Closet Replacement (Family Housing)

New low volume flush water closets (6.0 liters per flush) were evaluated for the family housing units. It is evident that the lower SIR and higher simple payback period do not justify the cost to install the water closets. WCO-3FH Water Closet Retrofits Using Early Closing Flappers has a higher SIR and lower payback period, therefore WCO-3AFH was rejected. The LCCID report, cost estimates, and calculations are in *Appendix D*.

## 2 METHODS AND APPROACH

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FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.

### 2.3.2 WCO-16 Sensor Controls for Faucets and Flush Valves

Sensor controls for faucets, urinals and toilets were evaluated for two barracks. It is evident that the savings do not justify the cost to install these systems. Other WCOs have higher SIR and lower payback periods so sensors were not evaluated for all buildings.

The water and energy savings are assumed to be equal to that calculated for WCO-1, WCO-3, and WCO-4. The LCCID reports, cost estimates, and calculations are in *Appendix D*.

## 2.4 COST ESTIMATES

The cost estimates for the WCOs were obtained using a variety of sources. This section explains how each part of the cost estimate was determined.

The initial cost for each WCO is the sum of the construction costs for the project and the project costs. The construction costs include all costs in materials, labor, and contractor's overhead and profit. The project costs include supervision, inspection, and) for the project and the project design costs.

### 2.4.1 Construction Costs

The construction costs for each WCO were estimated using *MeansData for Windows Spreadsheets*, Version 3.12, cost estimating software. Prices not available in the accompanying database were obtained using a combination of sources. These sources include the following:

- local suppliers and vendors
- Systems Corp's estimating data

All pricing has been adjusted, where applicable, to represent the labor costs in the Fort Belvoir, Virginia labor market. The construction cost estimates have been prepared to include a reasonable level of detail for each WCO calculated. The construction costs include an additional contingency and ten percent profit. A minimum contingency of ten percent was used, higher contingencies were used on some projects.

## 2 METHODS AND APPROACH

FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.

### 2.4.2 Project Costs

The project costs for each WCO include the cost of supervision, inspection, and overhead required to complete the project. A value of six percent of the construction cost has been used for the SIOH. Also included in the project costs is the cost to design each WCO. The design cost has been included at a fixed value of six percent of construction cost. This approach assures consistent values have been used for the project costs, allowing for combination of WCOs into larger projects without the need to adjust these values.

### 2.5 WCO - LIFE-CYCLE COSTS

The life-cycle cost analyses for the WCOs are a combination of energy costs, investment costs, maintenance costs, and replacement costs. Each of these components may, or may not, be significant factors in determining the life-cycle cost of the project. Each of these cost components has been evaluated for each WCO to determine the contribution, if any, to the life-cycle cost of the project.

The life-cycle costs were calculated using the computer program Life-Cycle Cost in Design (LCCID) as required in the Scope of Work.

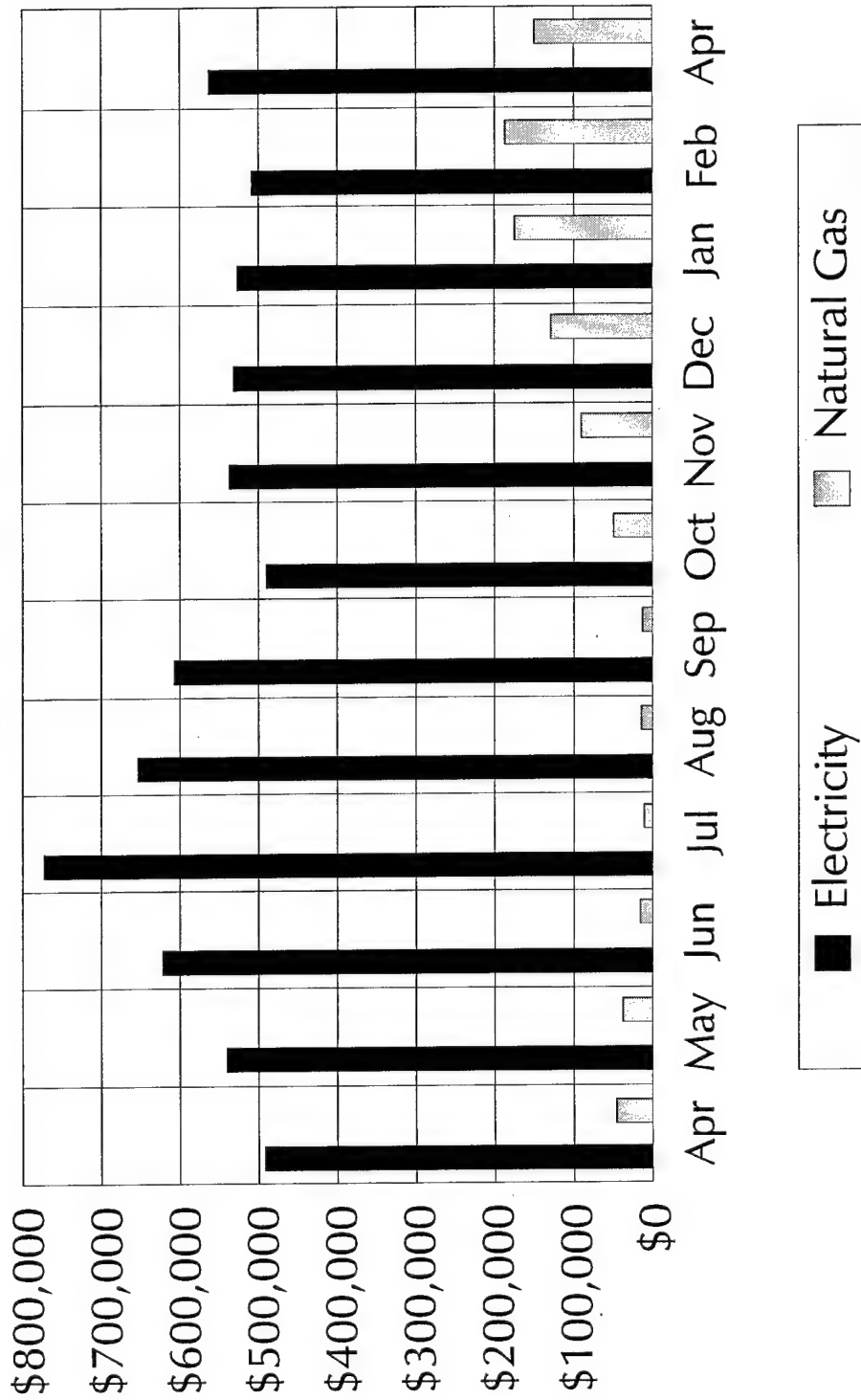
#### 2.5.1 Energy and Water Costs

Energy costs for each type of fuel used in the facilities included in this project were obtained from the installation and through the Defense Energy Information System (DEIS). The costs were obtained along with the amount of energy used for FY95. Average annual water, sewage and energy costs per unit were calculated. Electricity, fuel oil and natural gas are the only sources of energy related to the study. See *Figure 2.5.1.1 Fort Belvoir Energy Consumption - FY95* for costs of utility consumption.

Cost/MBtu	
Electric	= \$0.04730/KWH or \$47.30/MWH
Natural Gas	= \$5.33/MBtu or 18.19/MWH
Cost/Kgal	
Water	= \$0.67/KGAL or \$0.177/Kliter
Sewage	= \$2.14KGAL or \$0.565/Kliter

Figure 2.5.1.1  
FORT BELVOIR  
Energy Consumption

April '94 - April '95





## 2 METHODS AND APPROACH

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FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.

### 2.5.2 Maintenance and Replacement Costs

The maintenance and operating costs/savings for each WCO were calculated, where applicable. Considered first was whether the annual recurring (operation and maintenance) non-energy costs would significantly change as a result of each WCO. These values are sometimes unjustifiably manipulated to produce the desired results for the project economic analysis. Therefore, it was typically assumed that operation and maintenance activities will continue at the same rate as before the project. The estimated costs were obtained from the *Means Facilities Maintenance and Repair Costs Data*, 1995. For ECIP Project 1, \$19.72 is the estimated cost to replace a faucet cartridge on an annual basis. This maintenance cost was combined with the annual water savings to determine the annual recurring savings/costs for each facility.

The replacement costs (non-energy, non-annual recurring cost) for each WCO will be evaluated in the same manner as non-energy annual recurring cost. An example of this type of cost item is the replacement of the cartridge in spring-loaded faucets.

It is the policy of Systems Corp to be conservative when estimating these more subjective cost components which, if improperly evaluated, could result in inappropriate project qualification and funding decisions.

### 3 ECIP PROJECT 1

FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.

#### ECIP PROJECT 1 IMPLEMENTATION OF WCO-1: SPRING LOADED FAUCETS IN NON-FAMILY HOUSING UNITS

This section contains the project description and the DD1391 forms for ECIP Project 1, Implementation of WCO-1: Spring Loaded Faucets in Non-Family Housing Units. This project consists of replacing the existing lavatory faucets with new metering faucets. A list of the buildings included in the project follow the DD1391 forms. The list includes all buildings considered in the project in numerical order. Following this list is the LCCID report and the cost estimate for the proposed project. Calculation sheets for the individual buildings follow the project cost estimate.

Below is a detailed index of the information included in this section.

DD1391 Form .....	3-2
<i>Table 3.1 WCO-1: Spring Loaded Faucets in Non-Family Housing Units</i> .....	3-6
Project LCCID Report .....	3-7
Cut Sheets/Product Information .....	3-8
Project Cost Estimate.....	3-10
Building Calculation Sheets .....	3-13

### 3 ECIP PROJECT 1

FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.

DATE: March 18, 1996  
PROJECT NO.: ECIP-1  
PROJECT TITLE: Implementation WCO-1: Spring Loaded Faucets  
INSTALLATION: Fort Belvoir  
LOCATION: Virginia

#### PRIMARY FACILITY

Lavatory Faucets .....	\$698,465
Estimated Contract Cost.....	\$561,266
Contingency Percent (10%) .....	62,363
Subtotal .....	623,629
Supervision, Inspection & Overhead (5%) .....	37,418
Design Cost .....	37,418
Total Request .....	698,465
Total Request (Rounded).....	\$698,465

Replace lavatory faucets in 189 non-family housing units with water saving, metering faucets 1.9 liters per minute (0.5 gallons per minute). The project will significantly reduce potable water and energy consumption and sanitary waste production.

### 3 ECIP PROJECT 1

FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.

DATE: March 18, 1996  
PROJECT NO.: ECIP-1  
PROJECT TITLE: Implementation of WCO-1: Spring Loaded Faucets  
INSTALLATION: Fort Belvoir  
LOCATION: Virginia

#### PROJECT:

Replace lavatory faucets in 189 non-family housing buildings with water saving, 1.9 liters per minute (0.5 gallons per minute) metering faucets.

#### REQUIREMENTS:

Fort Belvoir utilizes inefficient lavatory faucets in its non-family housing buildings. The existing lavatory faucets dispense significantly more water and generate greater quantities of sanitary waste than the proposed metering faucet. Water savings occur due to reduced flow rates when using the metering faucet at 1.9 LPM (0.5 gpm) for a 30-second duration as compared to 5.2 LPM (1.375 gpm) using the existing faucets and aerators for the same time period. Energy savings occur when using the metering faucet to the reduced flow rate, which requires proportionately less hot water per use as compared to using the standard faucets. Again, the faucet closes automatically after 30 seconds while standard faucets may be left running. The proposed faucets can save countless gallons of wasted hot water. The U.S. Army Corp of Engineers, Baltimore District, contracted an Energy Engineering Analysis Program (EEAP) Water Conservation Study of the post. The study identified energy and water conservation opportunities. Life-cycle cost analysis was performed on each opportunity to determine its discounted savings-to-investment ratio (SIR) and estimated payback period. This project has an SIR of 2.21 and a simple payback period of 7.12 years. The project exceeds the minimum requirements of an SIR greater than 1.25 and a simple payback of less than ten years.

#### CURRENT SITUATION:

The buildings at Ft. Belvoir have inefficient lavatory faucets. The buildings consume more water and energy and generate more sanitary waste than is necessary. The proposed metering faucets will greatly reduce water consumption and waste generated.

#### IMPACT IF NOT PROVIDED:

If this project is not implemented, 189 buildings will continue to consume more water and generate more waste than necessary. The U.S. Army will fail to realize an estimated \$40,620 in annual savings (FY96\$) and a total discounted savings of \$1,540,553 during the twenty year life of the project.

### 3 ECIP PROJECT 1

*FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.*

#### ADDITIONAL:

A life-cycle cost analysis was performed on the project. The project will realize water savings of over 1.8 times the initial investment cost and will pay for itself in less than 8.0 years.

Ft. Belvoir is not on the list of installations considered for closure or realignment.

### 3 ECIP PROJECT 1

*FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.*

DATE: March 18, 1996  
PROJECT NO.: ECIP-1  
PROJECT TITLE: Implementation of WCO-1: Spring Loaded Faucets  
INSTALLATION: Fort Belvoir  
LOCATION: Virginia

#### SECTION 11 - ECONOMIC ANALYSIS DATA

##### 11D ECONOMIC JUSTIFICATION SUMMARY

This water conservation project is recommended for funding. A life-cycle cost analysis was performed on each portion of this project and on the overall project. The overall project will realize water savings of over 1.8 times the initial investment cost and will pay for itself in less than 8.0 years.

Table 3.1  
WCO-1: SPRING LOADED FAUCETS IN NON-FAMILY  
HOUSING UNITS

FAC NO.	FAC NO.	FAC NO.	FAC NO.	FAC NO.	FAC NO.	FAC NO.
20	219	319	505	1108	1445	2113
65	219B	320	506	1116	1462	2115
66	220	322	507	1132	1464	2116
69	221	323	508	1147	1465	2118
71	222	324	509	1148	1466	2119
75	223	325	610	1150	1467	2302
80	226	326	612	1154	1468	2310
81	235	328	630	1161	1469	2393
182	238	329	707	1165	1471	2470
187	246	330	708	1166	1472	2990
189	247	331	711	1167	1496	3121
191	256	333	712	1168	1801	3123
200	257	334	714	1182	1804	3126
201	258	337	801	1194	1809	3128
202	259	357	802	1195	1822	3136
204	268	361	806	1199	1824	3137
205	270	362	807	1200	1906	3141
206	303	363	808	1415	1949	3145
207	305	365	815	1416	1955	3146
208	307	367	1000	1417	2101	3151
209	309	371	1001	1419	2102	3165
210	312	374	1003	1425	2103	3230
211	314	380	1018	1434	2104	3231
212	315	392	1024	1436	2105	3232
214	316	399	1028	1439	2109	3234
215	317	435	1084	1442	2110	3235
216	318	470	1099	1444	2111	3237

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: BVRECIP1  
LCCID FY95 (92)

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FT BELVOIR      REGION NOS. 3      CENSUS: 3

PROJECT NO. & TITLE: 94013.09      FT BELVOIR WATER CONSERVATION STUDY

FISCAL YEAR 96      DISCRETE PORTION NAME: WCO 1 SPRING LOADED FAUCETS

ANALYSIS DATE: 06-25-96      ECONOMIC LIFE 20 YEARS      PREPARED BY: DRISKILL

1. INVESTMENT

A. CONSTRUCTION COST	\$ 623629.	
B. SIOH	\$ 37418.	
C. DESIGN COST	\$ 37418.	
D. TOTAL COST (1A+1B+1C)	\$ 698464.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$ 0.	
F. PUBLIC UTILITY COMPANY REBATE	\$ 0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)		\$ 698464.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1994

FUEL	UNIT COST \$/ MWH (1)	SAVINGS MWH/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT	\$ 47.30	0.	\$ 0.	15.08	\$ 0.
B. DIST	\$ .00	0.	\$ 0.	18.57	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	21.02	\$ 0.
D. NAT G	\$ 18.19	1241.	\$ 22565.	18.58	\$ 419266.
E. COAL	\$ .00	0.	\$ 0.	16.83	\$ 0.
F. PPG	\$ .00	0.	\$ 0.	17.38	\$ 0.
M. DEMAND SAVINGS			\$ 0.	14.88	\$ 0.
N. TOTAL		1241.	\$ 22565.		\$ 419266.

3. NON ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)

(1) DISCOUNT FACTOR (TABLE A)	14.88	\$ 40620.
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 604424.

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS (+) COST (-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS (+) / COST (-) (4)
1. REPLACEMENT	\$ 698464.	10	.74	516863.
d. TOTAL				516863.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2+3Bd4) \$ 1121288.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$  \$ 98109.

5. SIMPLE PAYBACK PERIOD (1G/4) 7.12 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 1540553.

7. SAVINGS TO INVESTMENT RATIO (SIR) =  $(6 / 1G) =$  2.21  
(IF < 1 PROJECT DOES NOT QUALIFY)

\*\*\*\* Project does not qualify for ECIP funding; 4,5,6 for information only.

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): N/A



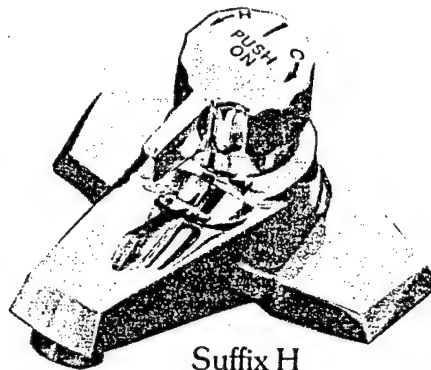
# SCOT

## Slow-Closing Omni Temperature LAVATORY FAUCET

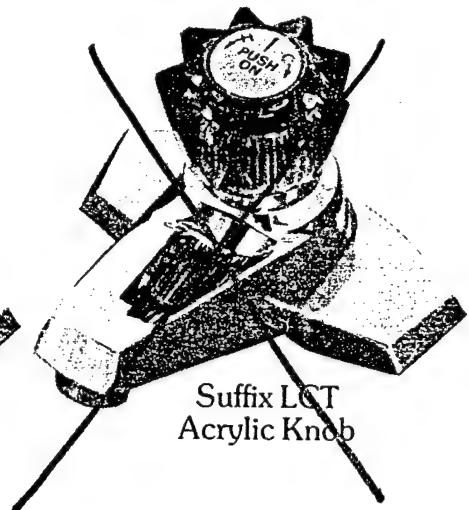
The metering faucet with temperature selection



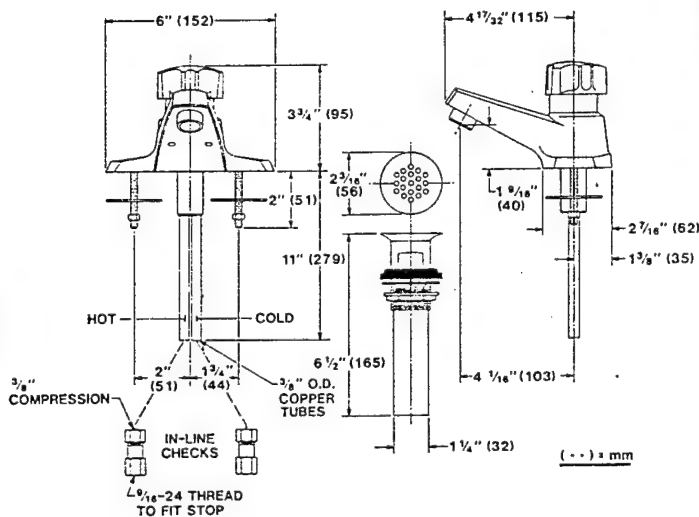
Standard Handle



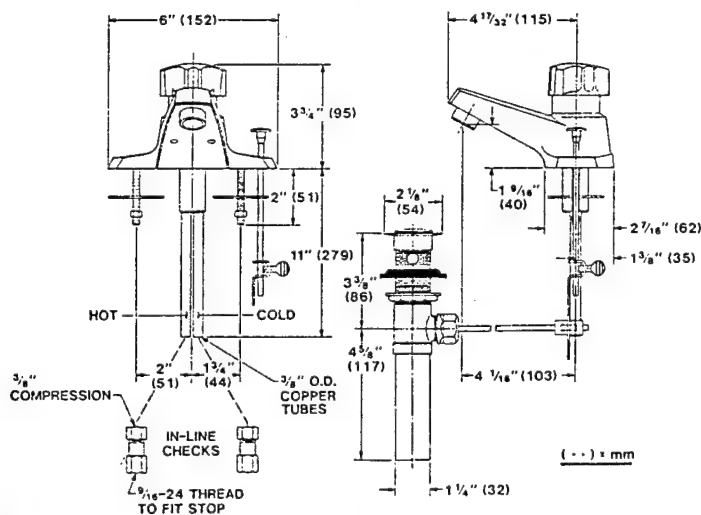
Suffix H  
Blade Handle



Suffix LCT  
Acrylic Knob



S-60-G



S-60-P

- ☒ **S-60-G** Symmons SCOT Metering/Temperature Selection Faucet.  
4" Centerset Slow-Closing lavatory faucet to meter and mix hot and cold water supply. Temperature limit stop to adjust outlet temperature. Time limit stop to adjust flow time. Rose spray outlet with 0.5 GPM flow rate. Vandal proof. ~~Grid strainer drain assembly.~~

☐ **S-60-P** with pop-up drain assembly.

☐ **S-60-1** with lift rod only.

- ☒ **S-60** Faucet only.

### Modifications:

- ☐ Suffix A: Standard aerator in place of rose spray (with standard aerator flow rate is 1.25 GPM at 50 psi).
- ☐ Suffix LCT: Acrylic multi-faceted knob.
- ☐ Suffix QC: For quick-closing feature.
- ☐ Suffix IPS: With 1/2" IPS connections.
- ☐ Suffix STE: Supply tube extensions, 8" w/compression couplings.
- ☐ Suffix H: Blade type handle for Barrier-Free application.

Job.....  
.....  
.....  
.....  
.....  
.....

*Symmons* INDUSTRIES INC.

31 BROOKS DRIVE, BRAINTREE, MASSACHUSETTS 02184  
PHONE 617-848-2250

## FAUCET DESCRIPTION

- Chrome plated brass construction
- Metering faucet designed to deliver either tempered or ambient water.
- Vandal resistant handles

## OPERATION

- Push-on style handles

## FLOW

- Vandal resistant aerator limits water discharged to a maximum of .5 gpm
- Metering mechanism is adjustable, to allow the installer to compensate for supply line pressures of 20 to 80 psi. Must be adjusted by installer to automatically shut off after a specified time -period (10 to 20 seconds is recommended)

## CARTRIDGE

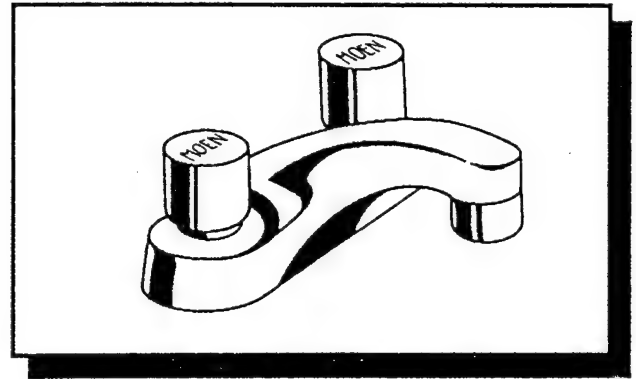
- 14807 cartridge design

## STANDARDS

- Designed and manufactured to comply with the requirements of: CSA B-125 and ASME A112.18.1M and all specifications referenced therein

## WARRANTY

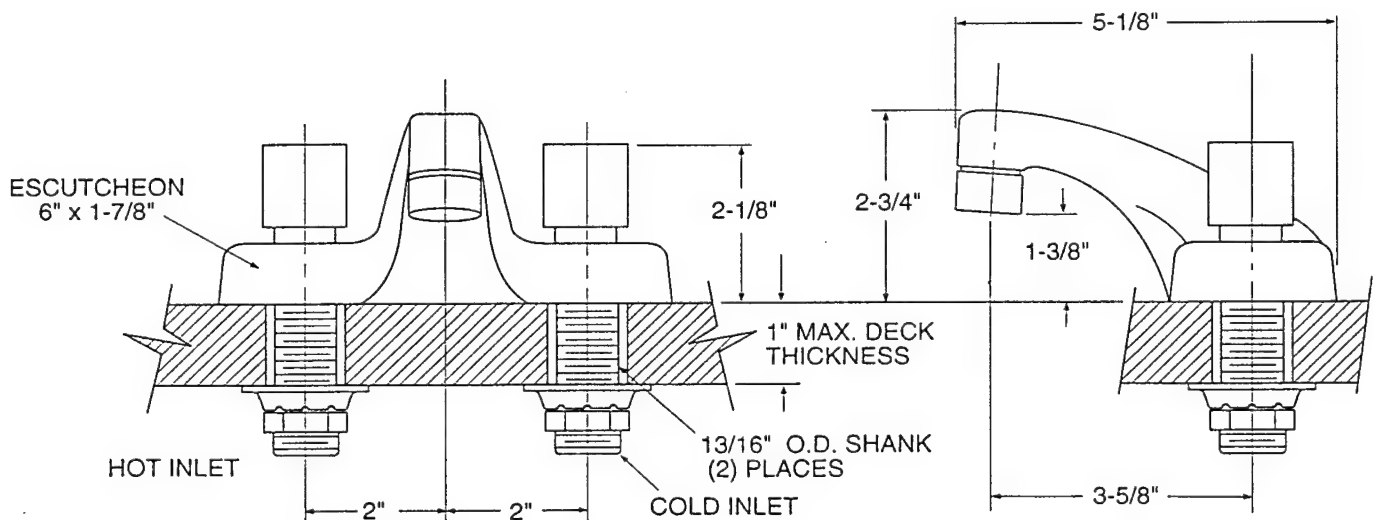
- Warranted for one year against material or manufacturing defects



**SANI-STREAM®**  
Two-Handle Metering Lavatory Faucet  
Model 8880 (Chrome)

**NOTE:** See reverse side  
for illustrated parts

**NOTE:** DESIGNED TO INSTALL THRU  
2-1" MIN. DIA. HOLES. 4" ON CENTER



**FRONT VIEW**

**SIDE VIEW**

## CRITICAL DIMENSIONS

(DO NOT SCALE)

PAGE 3-9

```

=====
Estimate:      WCO - 1          Date:      08-Mar-96
Description:    INSTALL SPRING LOADED FAUCETS
Project:        LIMITED EEAP (WTR) Bid Date:
Location:       FORT BELVOIR, VA Job #:      94013.09
Sq. footage:    PROJECT SUMMARY City indx: Alexandria, VA
=====

```

Line #	Description	Manhours	Matl	Labor	Equipment	Sub	Total
1511412810	WCO - 1, INSTALL SPRING LOADED LAVATORY FAUCET INCL DEMO OF EXISTING					2338.00 Ea.	
Unit values		2.50	118.00	52.72	0.00	0.00	170.72
Totals		5845.00	\$275,884	\$123,260	\$0	\$0	\$399,144
1511412820	WCO - 1, REPLACE 6 STN WTR TROUGH WITH CIRC WASH FOUNTAIN INCL DEMO OF EXIST.					2.00 Ea.	
Unit values		8.00	2635.00	170.00	0.00	0.00	2805.00
Totals		16.00	\$5,270	\$340	\$0	\$0	\$5,610
U15 MECHANICAL		5861	\$281,154	\$123,600	\$0	\$0	\$404,754

```
=====
Line #      Description
-----
      Manhours   Matl     Labor   Equipment   Sub     Total
=====

ESTIMATE TOTAL      5861  $281,154  $123,600          $0          $0  $404,754

SALES TAX           4.50%   $12,652
MATL MARKUP         11.00%   $30,927
LABOR MARKUP        33.00%           $40,788
EQUIPT MARKUP       5.00%           $0
SUB MARKUP          5.00%           $0

TOTAL BEFORE CONTINGENC $324,733  $164,388          $0          $0  $489,121
CONTINGENCY          15.00%           $73,368
BOND                  2.50%           $12,228
PROFIT                10.00%           $48,912

JOB TOTAL                                $623,629
```

```

=====
Estimate:      WCO - 1          Date:      08-Mar-96
Description:   INSTALL SPRING LOADED FAUCETS
Project:       LIMITED EEAP (WTR) Bid Date:
Location:     FORT BELVOIR, VA  Job #:      94013.09
Sq. footage:  PROJECT SUMMARY  City indx: Alexandria, VA
=====

```

## SUMMARY

```

-----
              Manhours   Matl      Labor   Equipment   Sub      Total
=====
U15 MECHANICAL    5861   $281,154   $123,600           $0         $0   $404,754
TOTAL             5861   $281,154   $123,600           $0         $0   $404,754

SALES TAX          4.50%   $12,652
MATL MARKUP        11.00%   $30,927
LABOR MARKUP       33.00%           $40,788
EQUIPT MARKUP      5.00%           $0
SUB MARKUP         5.00%           $0

TOTAL BEFORE CONTINGENC $324,733   $164,388           $0         $0   $489,121
CONTINGENCY        15.00%           $73,368
BOND                2.50%           $12,228
PROFIT             10.00%           $48,912

JOB TOTAL                                     $623,629

```

FY 95S EEAP FT. BELVOIR WATER CONSERVATION STUDY										1 OF 2	
CALCULATION WORK SHEET 1										DATE: 1 MAR 96	
FACILITY NO.:		POSTWIDE		Function:		Multiple					
Occupancy:		12155 / 132		Avg Operating Hours:		8 HRS/DAY		300 DAYS / YEAR			
WCO Number	Existing Fixture System	LPM	Retrofited Fixture System	LPM	Usage	Fixtures	Water Leaks				
WCO Type	Description		Description		Hrs/Yr/Fix	Quantity	Eliminated LPY				
1											
Lav Faucets	Dual Control Lav	9.5	Install Spring-Loaded Faucet	1.9	103.98	2338					
Wash Sink	Trough W/ 6 Stations	45.4	Rpl W/ 36" Circ Wash Ftn	7.0	1320	2					
WCO1 TOTAL:		LPM		LPM		2340	0				
2											
Misc Sinks											
WCO2 TOTAL:		LPM		LPM	#FL/YR	0	0				
3											
Water Closets											
3A											
Water Closets											
WCO3 TOTAL:		LPM		LPM	#FL/YR	0	0				
4											
Urinals											
WCO4 TOTAL:		LPM		LPM	HRS/YR	0	0				
5											
Shower Heads											
USE FACTORS											
Lav Faucets	Based on (4 Min / Day Running Time / Person) / # of Fixtures										
Misc Sinks	Based on (15 Min / Day) / # of Fixtures										
Water Closets	Based on (Each Person Flushing Twice Daily) / # of Fixtures										
Urinals	Based on ( Male Bldg Occupants Flushing 3 Times Daily) / # of Fixtures										
	Assuming 50% of Bldg Occupants Are Male										



## 4 FEMP PROJECT 1

FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.

### FEMP PROJECT 1: IMPLEMENTATION OF WCO-2: FAUCET AERATORS IN NON-FAMILY HOUSING

The project consists of installing new 9.5 liters per minute (2.5 gallons per minute) faucet aerators on all general purpose sinks in 106 non-family housing buildings. Most sinks were found to have faucet aerators; however, a high percentage of the aerators are in deteriorating condition. The discounted savings are \$165,230 with an SIR of 66.55.

The project includes removal of existing deteriorating aerators and installing new aerators. The construction cost is estimated to be \$3,289.

Below is a detailed index of the information included in this section:

<i>Table 4.1 WCO-2: Faucet Aerators in Non-Family Housing</i> .....	4-2
Project LCCID Report .....	4-3
Catalog Cut Sheet .....	4-4
Project Cost Estimate.....	4-6
Project Calculation Sheets .....	4-9



Table 4.1 WCO-2: FAUCET AERATORS IN NON-FAMILY HOUSING			
FAC NO.	FAC NO.	FAC NO.	FAC NO.
20	326	1415	3237
65	328	1436	
66	330	1465	
69	331	1472	
71	334	1809	
75	353	1822	
80	363	1906	
81	365	1949	
191	367	1950	
200	317	1955	
201	380	2101	
204	392	2102	
205	399	2103	
206	505	2104	
207	506	2105	
208	507	2109	
209	508	2110	
210	509	2111	
211	612	2113	
212	707	2115	
214	708	2302	
215	711	2310	
220	712	2470	
221	808	2990	
222	1024	3123	
223	1028	3126	
226	1084	3136	
235	1099	3137	
246	1116	3141	
247	1132	3145	
270	1147	3146	
305	1148	3151	
317	1195	3165	
322	1199	3231	
323	1200	3235	

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: BVRFEMP1

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID FY95 (92)

INSTALLATION & LOCATION: FT BELVOIR REGION NOS. 3 CENSUS: 3

PROJECT NO. & TITLE: 94013.09 FT BELVOIR WATER CONSERVATION STUDY

FISCAL YEAR 1996 DISCRETE PORTION NAME: WCO 2 INSTALL AERATORS MISC SINK

ANALYSIS DATE: 03-14-96 ECONOMIC LIFE 20 YEARS PREPARED BY: DRISKILL

1. INVESTMENT

A. CONSTRUCTION COST	\$	2937.		
B. SIOH	\$	176.		
C. DESIGN COST	\$	176.		
D. TOTAL COST (1A+1B+1C)	\$	3289.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.		
F. PUBLIC UTILITY COMPANY REBATE	\$	0.		
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$			3289.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1994

FUEL	UNIT COST \$/ MWH (1)	SAVINGS MWH/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT	\$ 47.30	0.	\$ 0.	15.08	\$ 0.
B. DIST	\$ .00	0.	\$ 0.	18.57	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	21.02	\$ 0.
D. NAT G	\$ 18.19	159.	\$ 2890.	18.58	\$ 53693.
E. COAL	\$ .00	0.	\$ 0.	16.83	\$ 0.
F. PPG	\$ .00	0.	\$ 0.	17.38	\$ 0.
M. DEMAND SAVINGS			\$ 0.	14.88	\$ 0.
N. TOTAL		159.	\$ 2890.		\$ 53693.

3. NON ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)		\$ 11104.
(1) DISCOUNT FACTOR (TABLE A)	14.88	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 165230.

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS (+) COST (-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS (+) / COST (-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2+3Bd4) \$ 165230.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS\ ECONOMIC\ LIFE))$  \$ 13994.

5. SIMPLE PAYBACK PERIOD (1G/4) .24 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 218923.

7. SAVINGS TO INVESTMENT RATIO (SIR) = (6 / 1G) = 66.55  
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 27.06 %



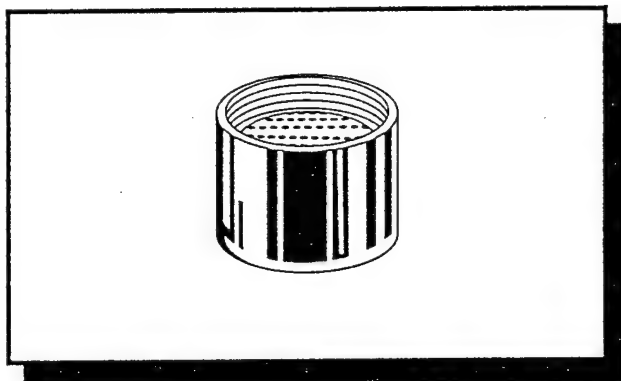
## Specifications

### DESCRIPTION

- Chrome plated brass and synthetic materials
- Spanner wrench included

### WARRANTY

- Warranted for one year against material or manufacturing defects



**SANI-STREAM®**  
Aerator, Female  
Vandal Resistant  
2.5 gpm  
Model 52619

KITCHEN FAUCETS

55/64" X 27 MALE THREAD

### CRITICAL DIMENSIONS

(DO NOT SCALE)

PAGE 4 - 4



## FLOW REGULATED OUTLETS

To fit most faucets manufactured by the plumbing industry. Adapters supplied have hex socket to aid in fastening flow control securely to faucet.

## IMPORTANT NOTE:

When ordering specify flow rate desired by adding suffix as noted in table below. All flow controls are color coded.

2.5 GPM



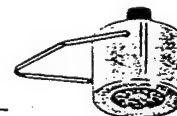
**B-199-1-F** Flow Control Aerator  
Non-splash aerator provides flow regulated supply of water for washing etc. yet reduces consumption of water to pre-determined quantities.  $\frac{5}{16}$ "-27 female aerator thread.



**B-199-6-F** Vandal Resistant Flow Control Aerator  
Non-splash aerator attached with tool supplied. Removable only with tool otherwise spins freely. Provides an adequate supply of water yet reduces consumption of water to pre-determined quantities.  $\frac{5}{16}$ "-27 female aerator thread.



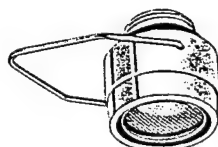
**B-199-12-F** Vandal Resistant Flow Control Aerator with Anti-Hose Ring  
Non-splash aerator attached with tool supplied. Removable only with tool otherwise spins freely. Unit has protruding ring to prevent attaching hose to aerator. Provides an adequate supply of water yet reduces consumption of water to pre-determined quantities.  $\frac{5}{16}$ "-27 female aerator thread fits most nozzles and many goosenecks.



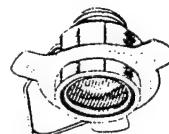
**B-199-16-F** Vandal Resistant Flow Control with Non-Aerated Spray  
Unit provides a non-aerated spray pattern which supplies adequate water for washing etc. Unique design produces pre-determined flow with a moderate velocity at low water usage. Installed with tool supplied, unit spins freely and can be removed only with tool. Available with 0.7 G.P.M. and 0.9 G.P.M. flow controls only.  $\frac{5}{16}$ "-27 female aerator thread.



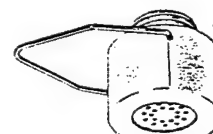
**B-199-2-F**  
Same as B-199-1-F except has  $\frac{3}{8}$ " IPS male thread adapter.



**B-199-7-F**  
Same as B-199-6-F except has  $\frac{3}{8}$ " IPS male thread adapter.



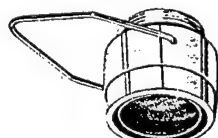
**B-199-13-F**  
Same as B-199-12-F except has  $\frac{3}{8}$ " IPS male thread adapter.



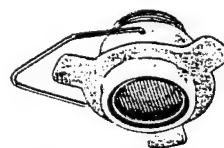
**B-199-17-F**  
Same as B-199-16-F except has  $\frac{3}{8}$ " IPS male thread adapter.



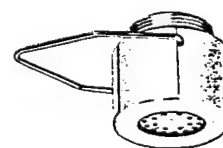
**B-199-3-F**  
Same as B-199-1-F except has  $\frac{13}{16}$ "-27 male thread adapter.



**B-199-8-F**  
Same as B-199-6-F except has  $\frac{13}{16}$ "-27 male thread adapter.



**B-199-14-F**  
Same as B-199-12-F except has  $\frac{13}{16}$ "-27 male thread adapter.



**B-199-18-F**  
Same as B-199-16-F except has  $\frac{13}{16}$ "-27 male thread adapter.



### B-198-F Low Splash Serrated Tip

Serrated tip with flow control provides smooth stream of water but minimizes splash associated with serrated hose ends. Use of flow controls above 0.5 G.P.M. will be less effective in reducing splash, however will still cut water consumption to a pre-determined rate.  $\frac{3}{8}$ " IPS male thread. Accepts plastic or rubber tubing up to  $\frac{1}{2}$ " inside diameter.

TABLE

FLOW (GPM $\pm$ 15%)	SUFFIX	MODELS BEST USED ON	COLOR CODE
0.25	F-03	Used on B-198-F only	No color
0.40	F-05		Tan
0.70	F-07		Green
0.90	F-10	All Models shown	Grey
1.20	F-12		Orange
1.40	F-15		Purple
2.00	F-20	Can be used on all models shown except B-199-16-F, B-199-17-F, B-199-18-F, and B-199-19-F	Yellow
2.50	F-25		White
3.00	F-30		Blue

**To order:**  
Select flow desired then add suffix to Model Number.

**For Example:** B-199-2-F-15

**\*Note:**  
Painted mark on each flow control within the assembly indicates flow of unit.

```

=====
Estimate:      WCO - 2          Date:      12-Mar-96
Description:    INSTALL AERATORS, MISC SINKS
Project:        LIMITED EEAP (WTR) Bid Date:
Location:       FORT BELVOIR, VA  Job #:      94013.09
Sq. footage:    PROJECT SUMMARY  City indx: Alexandria, VA
=====

```

Line #	Description	Manhours	Matl	Labor	Equipment	Sub	Total
1511412810	WCO - 2, INSTALL AERATOR, MISCELLANEOUS SINKS					282.00 Ea.	
Unit values		0.25	1.00	5.27	0.00	0.00	6.27
Totals		70.50	\$282	\$1,487	\$0	\$0	\$1,769
U15 MECHANICAL		71	\$282	\$1,487	\$0	\$0	\$1,769

```
=====
Line #      Description
-----
           Manhours   Matl    Labor   Equipment   Sub    Total
=====

ESTIMATE TOTAL      71      $282    $1,487        $0        $0    $1,769

SALES TAX            4.50%      $13
MATL MARKUP          11.00%     $31
LABOR MARKUP         33.00%           $491
EQUIPT MARKUP        5.00%           $0
SUB MARKUP           5.00%           $0

TOTAL BEFORE CONTINGENC      $326    $1,978        $0        $0    $2,303
CONTINGENCY          15.00%           $346
BOND                  2.50%           $58
PROFIT                10.00%           $230

JOB TOTAL                                $2,937
```

```

=====
Estimate:      WCO - 2          Date:      12-Mar-96
Description:   INSTALL AERATORS, MISC SINKS
Project:      LIMITED EEAP (WTR) Bid Date:
Location:     FORT BELVOIR, VA  Job #:      94013.09
Sq. footage:  PROJECT SUMMARY  City indx: Alexandria, VA
=====

```

## SUMMARY

```

-----
Manhours  Matl  Labor  Equipment  Sub  Total
=====
U15 MECHANICAL      71      $282    $1,487          $0      $0    $1,769
TOTAL                71      $282    $1,487          $0      $0    $1,769

SALES TAX           4.50%      $13
MATL MARKUP         11.00%     $31
LABOR MARKUP        33.00%          $491
EQUIPT MARKUP        5.00%          $0
SUB MARKUP           5.00%          $0

TOTAL BEFORE CONTINGENC      $326    $1,978          $0      $0    $2,303
CONTINGENCY           15.00%          $346
BOND                   2.50%          $58
PROFIT                 10.00%          $230

JOB TOTAL                                $2,937

```

FY 95S EEAP FT. BELVOIR WATER CONSERVATION STUDY										1 OF 2	
CALCULATION WORK SHEET 1										DATE: 12 MAR 96	
FACILITY NO. : POSTWIDE		Function: Multiple		Operating Hours: 8 HRS/DAY		300 DAYS / YEAR					
Occupancy: 7389											
WCO Number	Existing Fixture System	Retrofitted Fixture System	Usage	Fixtures	Water Leaks						
WCO Type	Description	LPM	Hrs/Yr/Fix	Quantity	Eliminated LPY						
1											
Lav Faucets											
WCO1 TOTAL:		LPM		0	0						
2											
Misc Sinks	Sinks	45.40	49	282							
WCO2 TOTAL:		LPF		282	0						
3											
Water Closets											
3A											
Water Closets											
WCO3 TOTAL:		LPF		0	0						
4											
Urinals											
WCO4 TOTAL:		LPM		0	0						
5											
Shower Heads											
USE FACTORS											
Lav Faucets	Based on (4 Min / Day Running Time / Person) / # of Fixtures										
Misc Sinks	Based on (15 Min / Day) / # of Fixtures										
Water Closets	Based on (Each Person Flushing Twice Daily) / # of Fixtures										
Urinals	Based on ( Male Bldg Occupants Flushing 3 Times Daily) / # of Fixtures										
	Assuming 50% of Bldg Occupants Are Male										

**SYSTEMS CORP** Systems Engineering and Management Corporation, Knoxville, TN





## 5 FEMP PROJECT 2

FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.

### FEMP PROJECT 2: IMPLEMENTATION OF WCO-3: FLUSH VALVE RETROFITS FOR WATER CLOSETS

The project consists of installing more efficient flush valve repair parts to significantly reduce the volume of water and sanitary waste of the flush valves which are presently used at Fort Belvoir. The repair kits will be installed in 178 non-family buildings. The discounted savings is \$291,530 with an SIR of 1.68.

The project includes removal of parts from the body of the existing flush valves and replacing the parts with new repair kit parts to reduce the volume of water used for flushing to 13.2 liters per flush. The construction cost is estimated to be \$173,681.

Below is a detailed index of the information included in this section:

<i>Table 5.1 WCO-3: Flush Valve Retrofits for Water Closets</i> .....	5-2
Project LCCID Report .....	5-3
Catalog Cut Sheet .....	5-4
Project Cost Estimate .....	5-7
Project Calculation Sheets .....	5-10

## 5 FEMP PROJECT 2

FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.

Table 5.1 WCO-3: FLUSH VALVE RETROFITS FOR WATER CLOSETS						
FAC NO.	FAC NO.	FAC NO.	FAC NO.	FAC NO.	FAC NO.	FAC NO.
20	219 B	320	505	1148	1469	2310
65	220	322	506	1150	1471	2393
66	221	323	610	1154	1472	2470
69	222	324	612	1163	1496	2990
71	223	325	630	1182	1804	3121
75	226	326	707	1194	1809	3123
182	235	328	708	1195	1822	3126
187	238	329	711	1199	1824	3128
189	246	330	712	1200	1906	3136
191	247	331	714	1414	1949	3137
200	256	333	801	1415	1950	3138
201	257	334	802	1416	1955	3141
202	259	337	806	1417	2101	3145
204	268	353	807	1419	2102	3146
205	270	357	808	1425	2103	3151
206	303	361	815	1434	2104	3165
207	305	362	1003	1436	2105	3230
208	307	363	1018	1442	2109	3231
209	309	365	1024	1444	2110	3232
210	312	367	1028	1445	2111	3234
211	314	371	1084	1462	2113	3235
212	315	380	1099	1464	2115	3237
214	316	392	1108	1465	2116	
215	317	399	1116	1466	2118	
216	318	435	1132	1467	2119	
219	319	470	1147	1468	2302	

LIFE CYCLE COST ANALYSIS SUMMARY

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)      STUDY: BVRFEMP2  
 INSTALLATION & LOCATION: FT BELVOIR      REGION NOS. 3      LCCID FY95 (92)  
 PROJECT NO. & TITLE: 94013.09      FT BELVOIR WATER CONSERVATION STUDY  
 FISCAL YEAR 1996      DISCRETE PORTION NAME: WCO 3 13.3 FLUSH VALVE RETROFIT  
 ANALYSIS DATE: 03-14-96      ECONOMIC LIFE 20 YEARS      PREPARED BY: DRISKILL

1. INVESTMENT

A. CONSTRUCTION COST	\$	155072.	
B. SIOH	\$	9304.	
C. DESIGN COST	\$	9304.	
D. TOTAL COST (1A+1B+1C)	\$	173681.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.	
F. PUBLIC UTILITY COMPANY REBATE	\$	0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		173681.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1994

FUEL	UNIT COST \$/ MWH(1)	SAVINGS MWH/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 47.30	0.	\$ 0.	15.08	\$ 0.
B. DIST	\$ .00	0.	\$ 0.	18.57	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	21.02	\$ 0.
D. NAT G	\$ 18.19	0.	\$ 0.	18.58	\$ 0.
E. COAL	\$ .00	0.	\$ 0.	16.83	\$ 0.
F. PPG	\$ .00	0.	\$ 0.	17.38	\$ 0.
M. DEMAND SAVINGS			\$ 0.	14.88	\$ 0.
N. TOTAL		0.	\$ 0.		\$ 0.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)

(1) DISCOUNT FACTOR (TABLE A)	14.88	\$ 19592.
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 291530.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-) (4)
------	------------------------------	-----------------	------------------------	--

d. TOTAL      \$      0.      0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4) \$ 291530.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$  \$ 19592.

5. SIMPLE PAYBACK PERIOD (1G/4) 8.86 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 291530.

7. SAVINGS TO INVESTMENT RATIO (SIR) =  $(6 / 1G) =$  1.68  
 (IF < 1 PROJECT DOES NOT QUALIFY)

\*\*\*\* Project does not qualify for ECIP funding; 4,5,6 for information only.

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): N/A

# SLOAN

## FLUSHOMETERS

### COVERS & INSIDE PARTS

- A-19-AC CLOSET Relief Valve
- A-19-AU URINAL Relief Valve
- A-15-A Disc
- A-156-A Diaphragm w/A-29
- A-153-A Guide Assembly
- A-36-A  
Inside Parts Kit for closets, service  
sinks, blowout and syphon jet urinals
- A-37-A  
Inside Parts Kit for washdown urinals
- A-38-A  
Retro Water Saver Kit - saves one  
gallon per flush for syphon jet closets

- A-72 Chrome Plated Cover
- A-71 Inside Cover

### TAILPIECES\* ADJUSTABLE TAILPIECE

- H-551-A 2 1/16" Chrome Plated  
Adjustable Tailpiece Assembly
- H-550 Chrome Plated Coupling
- H-553 "O" Ring
- H-552 Lock Ring

### CONTROL STOPS\*

#### SCREWDRIVER STOPS

- H-573 1" Chrome Plated  
Stop Cap
- H-582 3/4" Chrome Plated  
Stop Cap
- H-579 1" Bonnet
- H-577 3/4" Bonnet
- H-600-A 1" or 3/4" Chrom  
Plated Screwdriver BAK-C  
Control Stop
- H-600-AG 1" or 3/4" Chro  
Plated Screwdriver BAK-C  
Control Stop
- H-650-AG 1" Chrome Pla  
Screwdriver BAK-CHEK  
Control Stop
- H-541-A Repair Kit for 1"  
Screwdriver BAK-CHEK  
Control Stop
- H-543-A Repair Kit for 3/4"  
Screwdriver BAK-CHEK  
Control Stop

### HANDLE PARTS & ASSEMBLIES\*

- A-6 Chrome Plated handle Coupling
- B-7-A Chrome Plated Socket
- B-32 Chrome Plated Grip
- B-8-A Plunger
- C-7 Spring
- B-40 Bushing
- A-31 Handle Gasket
- B-39 Seal
- B-50-A Handle Repair Kit
- B-32-A Chrome Plated Handle Assembly  
also available as  
C-42-A 3" Chrome Plated Push  
Button Assembly
- A-156-AA Closet/Urinal washer set  
(includes b-39 Seal, A-156-A Diaphragm,  
A-15-A Disc and A-31 Gasket)

### GROUND JOINT TAILPIECE (not shown)

- H-5 1 3/4" Chrome Plated  
Ground Joint Coupling
- H-6 Chrome Plated Coupling

### WHEEL HANDLE STOPS (not shown)

- H-36 Chrome Plated Scr  
w/H-52 Washer
- H-575 Chrome Plated  
Wheel Handle
- H-556 Sound Absorbent  
Washer
- 3308060 Wheel Handle  
Repair Kit
- H-563 1" Bonnet
- H-561 3/4" Bonnet
- H-600-A 1" or 3/4" Chrom  
Plated Wheel Handle  
BAK-CHEK Control Stop
- H-650-AG 1" Chrome Pla  
Wheel Handle BAK-CHEK  
Control Stop
- H-541-A Repair Kit for 1"  
Wheel Handle BAK-CHEK  
Control Stop
- H-543-A Repair Kit for 3/4"  
Wheel Handle BAK-CHEK  
Control Stop

### VACUUM BREAKER PARTS & ASSEMBLIES\*

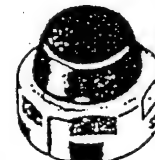
- V-500-A & V-500-AA Chrome Plated Vacuum  
Breaker Assm. & Vacuum Breaker Repair Kit

- F-5-A 1 1/2" Chrome Plated Spud Coupling  
Assembly. Also available for 3/4", 1" and  
1 1/4" spud couplings

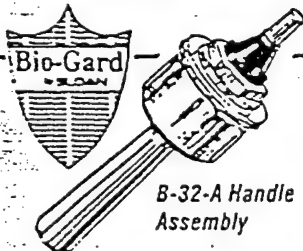
\*For additional information on Sloan  
Flushometers, parts, kits and as-  
semblies, please refer to the Repair  
Parts and Maintenance Guide.



H-574 Stop Bumper  
w/Cap (YO)



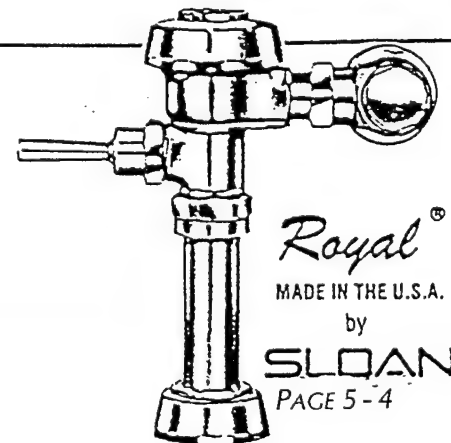
H-576 Stop Bumper  
w/extended Cap (YG)



B-32-A Handle  
Assembly

A Protective Coating  
that Effectively Controls  
Bacteria, Mold & Fungus!

ANTI-MICROBIAL  
ADDITIVE REGISTERED  
WITH THE E. P. A.



Royal®  
MADE IN THE U.S.A.  
by  
SLOAN

PAGE 5-4

## ORDERING INSTRUCTIONS

To place an order, for your convenience and assistance, contact your local Sales Representative. A list of area representatives are on the back of this price sheet.

### Exposed Flushometers with YB Variations (Sweat Solder Adaptor)

When ordering Flushometers with the YB Variation you may obtain the kit in two ways:

1) packed with the Flushometer-  
For Example:  
ROYAL 110-3 YB  
Order Code Number: 3010194

2) packed separately-  
For Example:  
ROYAL 110-3 and Sweat Solder Adaptor  
Order Code Numbers: 3010193 & 3308780

### Hydraulic Flushometers

When ordering Hydraulic Flushometers the Actuator must be specified and ordered separately.

For Example:  
ROYAL 910 YB  
Order Code Number: 3910180  
HY-33-A FW Actuator  
Order Code Number: 0318001

### Concealed Flushometers

When ordering Concealed Flushometers please specify the "L" Dimension and/or the Wall Thickness.

Also, please note if it is a Standard Concealed Installation or if it is to be used with a Wall Box Installation. If it is to be used with a Wall Box Installation, the Wall Box *must* be ordered separately:

\*On the Flushometer use the description only. DO NOT use the Code Number.

For Example:  
\*ROYAL 152 8" WALL THICKNESS FOR WALL BOX INSTALLATION  
WALL BOX ASSEMBLY  
Order Code Number: 0334030

Sloan Flushometers can be furnished to provide the following flush volumes to meet the requirements of all plumbing fixtures (new and existing) and code jurisdictions:

⊗ { MUST HAVE "LOW CONSUMPTION" FIXTURE  
TO WORK PROPERLY — NOT ENOUGH WATER  
FOR CONVENTIONAL FIXTURE. }

#### Closet Flushometers

a) Standard .....	4.5 GPF (Gallons per Flush)	A-36-A
b) Water Saver (specify by using "-3" suffix) .....	3.5 GPF	A-38-A
c) Low Consumption (specify by using "-1.5" suffix) .....	1.6 GPF	A-41-A ⊗

#### Urinal Flushometers (for 3/4" spud Urinals)

a) Standard .....	1.5 GPF	A-37-A
b) Low Consumption (specify by using "-1" suffix) .....	1 GPF	A-42-A ⊗

#### Urinal Flushometers (for 1 1/4" spud Urinals)

a) Standard .....	3 GPF	A-35-A
b) Water Saver (specify by using "-1.5" suffix) .....	1.5 GPF	A-37-A
c) Low Consumption (specify by using "-1" suffix) .....	1 GPF	A-42-A ⊗

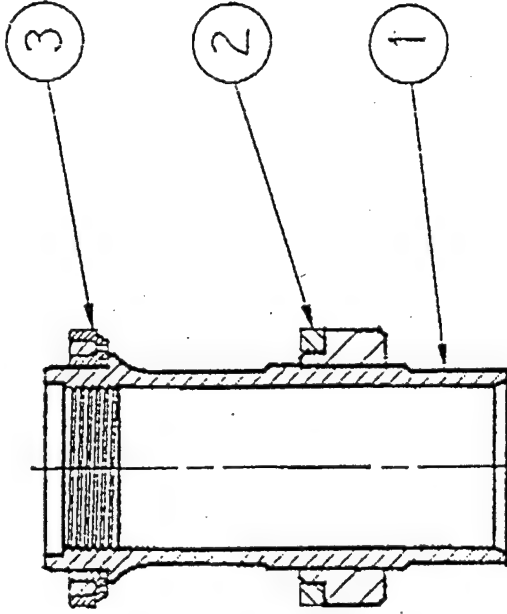
Sloan Flushometers are designed, manufactured and tested to the requirements of ASSE 1037 and ASME/ANSI A112.19.6M

#### Allowances for Parts Omitted

Each Flushometer listed in this price sheet has its own corresponding code number. When any part is omitted in your selection the code number will change, therefore, order using the full description less any references to code number.

Note: For other parts omitted allow 1/3 of net price of part.

ITEM	ALLOW
F-101 Outlet	.25
F-20 Spud Nut	.25
F-7 Spud Flange	.15
F-7 Wall Flange	.15
Control Stops	2.20
Vacuum Breakers	2.15

ITEM No.	DRWG No.	DESCRIPTION	QTY.	
1	A-163	GUIDE	1	
2	A-164	FLOW RING	1	
3	A-170	REFILL HEAD	1	

NOTE:  
REVERSE A-170 WHEN FURNISHED  
FOR 3 GAL. URINAL.

UNLESS OTHERWISE SPECIFIED

FRACTIONAL =  $\pm 1/64"$

DECIMAL .XX =  $\pm 0.10"$

DECIMAL .XXX =  $\pm .005"$

ANGULAR =  $\pm 2^\circ$

CONCENTRIC = .010TIR

<p><b>A 19277</b></p> <p>163-A</p> <p>CHANGES</p> <p>ECN 512 11-01-67 AN</p> <p>① ECN 718 06-09-70 CF</p> <p>② ECN4097 12-16-91 MI</p>	<p><b>CADD</b></p> <p>DATE 12-16-91</p> <p>DR. MH</p> <p>SCALE: 1 : 1</p> <p>A</p>	<p><b>ROYAL GUIDE ASSEMBLY</b></p> <p>DR. ABN TR.</p> <p>CHKD. APPR. RB</p> <p><b>SLOAN VALVE CO.</b> FRANKLIN PARK, IL.</p>
<p><b>A 19227</b></p> <p>163-A</p> <p>DATE 10-31-67</p>		

14-Mar-96

MeansData for Lotus

Page 1

```

=====
Estimate:      WCO - 3          Date:      14-Mar-96
Description:    UPGRADE WATER CLOSETS W/ 13.3 LPF FLUSH VALVES
Project:        LIMITED EEAP (WTR) Bid Date:
Location:       FORT BELVOIR, VA Job #:      94013.09
Sq. footage:    PROJECT SUMMARY  City indx: Alexandria, VA
=====

```

Line #	Description	Manhours	Matl	Labor	Equipment	Sub	Total
1511410972	WCO - 3, INSTALL 13.3 LPF FLUSH VALVE REPAIR KIT , INCL IN EXISTING WATER CLOSETS					1944.00 Ea.	
Unit values		1.24	24.00	26.20	0.00	0.00	50.20
Totals		2410.56	\$46,656	\$50,930	\$0	\$0	\$97,586
U15 MECHANICAL		2411	\$46,656	\$50,930	\$0	\$0	\$97,586



```
=====
Line #      Description
-----
      Manhours  Matl    Labor  Equipment  Sub    Total
=====
```

ESTIMATE TOTAL	2411	\$46,656	\$50,930	\$0	\$0	\$97,586
SALES TAX	4.50%	\$2,100				
MATL MARKUP	11.00%	\$5,132				
LABOR MARKUP	33.00%		\$16,807			
EQUIPT MARKUP	5.00%			\$0		
SUB MARKUP	5.00%				\$0	
TOTAL BEFORE CONTINGENC		\$53,888	\$67,737	\$0	\$0	\$121,625
CONTINGENCY	15.00%					\$18,244
BOND	2.50%					\$3,041
PROFIT	10.00%					\$12,162
JOB TOTAL						\$155,071

```

=====
Estimate:      WCO - 3          Date:      14-Mar-96
Description:    UPGRADE  WATER CLOSETS W/ 13.3 LPF FLUSH VALVES
Project:       LIMITED EEAP (WTR) Bid Date:
Location:      FORT BELVOIR, VA  Job #:      94013.09
Sq. footage:   PROJECT SUMMARY  City indx: Alexandria, VA
=====

```

## SUMMARY

```

-----
              Manhours   Matl      Labor   Equipment   Sub      Total
=====
U15 MECHANICAL    2411    $46,656    $50,930           $0          $0    $97,586
TOTAL              2411    $46,656    $50,930           $0          $0    $97,586

SALES TAX          4.50%     $2,100
MATL MARKUP        11.00%     $5,132
LABOR MARKUP       33.00%           $16,807
EQUIPT MARKUP      5.00%           $0
SUB MARKUP         5.00%           $0

TOTAL BEFORE CONTINGENC $53,888    $67,737           $0          $0    $121,625
CONTINGENCY        15.00%           $18,244
BOND                2.50%           $3,041
PROFIT             10.00%           $12,162

JOB TOTAL                                     $155,071

```

FY 95S EEAP FT. BELVOIR WATER CONSERVATION STUDY										1 OF 2	
CALCULATION WORK SHEET 1										DATE: 5 MAR 96	
FACILITY NO. :		POSTWIDE		Function:		Multiple					
Occupancy:		11894		Operating Hours:		8 HRS/DAY		300 DAYS / YEAR			
WCO Number	Existing Fixture System	LPM	Retrofited Fixture System	LPM	Usage	Fixtures	Water Leaks				
WCO Type	Description		Description		Hrs/Yr/Fix	Quantity	Eliminated LPY				
1											
Lav Faucets											
WCO1 TOTAL:		LPM		LPM		0	0				
2											
Misc Sinks											
WCO2 TOTAL:		LPM		LPM		0	0				
3											
Water Closets	Sloan Flush Valve	17.0	Install 13.3 LPF	13.3	3671	1944					
WCO3 TOTAL :		LPM		LPM		1944	0				
4											
Urinals											
WCO4 TOTAL :		LPM		LPM		0	0				
5											
Shower Heads											
USE FACTORS											
Lav Faucets	Based on (4 Min / Day Running Time / Person) / # of Fixtures										
Misc Sinks	Based on (15 Min / Day) / # of Fixtures										
Water Closets	Based on (Each Person Flushing Twice Daily) / # of Fixtures										
Urinals	Based on ( Male Bldg Occupants Flushing 3 Times Daily) / # of Fixtures										
	Assuming 50% of Bldg Occupants Are Male										

**SYSTEMS CORP** Systems Engineering and Management Corporation, Knoxville, TN



## 6 FEMP PROJECT 3

FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.

### FEMP PROJECT 3: IMPLEMENTATION OF WCO-4: FLUSH VALVE RETROFITS FOR URINALS

The project consists of installing more efficient flush valve repair parts to significantly reduce the volume of water and sanitary waste of the flush valves which are presently used at Fort Belvoir. The repair kits will be installed in 33 non-family buildings. The discounted savings is \$35,405 with an SIR of 3.87.

The project includes removal of parts from the body of the existing flush valve and replacing the parts with new repair kit parts to reduce the volume of water used for flushing to 3.79 liters per flush. The construction cost is estimated to be \$9,146.

Below is a detailed index of the information included in this section:

<i>Table 6.1 WCO-4: Flush Valve Retrofits for Urinals</i> .....	6-2
Project LCCID Report .....	6-3
Catalog Cut Sheet .....	6-4
Project Cost Estimate .....	6-6
Project Calculation Sheets .....	6-9

Table 6.1  
WCO-4: FLUSH VALVE RETROFITS FOR URINALS

FAC NO.	FAC NO.	FAC NO.	FAC NO.
20	318	1084	3136
189	320	1116	3136
201	325	1949	3141
215	357	2470	3145
219	612	3121	3146
238	808	3123	3151
257	815	3126	3165
259	1018	3128	3234

LIFE CYCLE COST ANALYSIS SUMMARY

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)      STUDY: BVRFEMP3  
 INSTALLATION & LOCATION: FT BELVOIR      REGION NOS. 3      LCCID FY95 (92)  
 PROJECT NO. & TITLE: 94013.09      FT BELVOIR WATER CONSERVATION STUDY  
 FISCAL YEAR 1996      DISCRETE PORTION NAME: WCO 4 5.7 LPF FLUSH VALVE RETROF  
 ANALYSIS DATE: 03-14-96      ECONOMIC LIFE 20 YEARS      PREPARED BY: DRISKILL

1. INVESTMENT

A. CONSTRUCTION COST	\$	8166.	
B. SIOH	\$	490.	
C. DESIGN COST	\$	490.	
D. TOTAL COST (1A+1B+1C)	\$	9146.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.	
F. PUBLIC UTILITY COMPANY REBATE	\$	0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		9146.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1994

FUEL	UNIT COST \$/ MWH (1)	SAVINGS MWH/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT	\$ 47.30	0.	\$ 0.	15.08	\$ 0.
B. DIST	\$ .00	0.	\$ 0.	18.57	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	21.02	\$ 0.
D. NAT G	\$ 18.19	0.	\$ 0.	18.58	\$ 0.
E. COAL	\$ .00	0.	\$ 0.	16.83	\$ 0.
F. PPG	\$ .00	0.	\$ 0.	17.38	\$ 0.
M. DEMAND SAVINGS			\$ 0.	14.88	\$ 0.
N. TOTAL		0.	\$ 0.		\$ 0.

3. NON ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)

(1) DISCOUNT FACTOR (TABLE A)	14.88	\$ 2379.
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 35405.

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS (+) COST (-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS (+) / COST (-) (4)
------	--------------------------------	-----------------	------------------------	---

d. TOTAL      \$ 0.      0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2+3Bd4) \$ 35405.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$  \$ 2379.

5. SIMPLE PAYBACK PERIOD (1G/4) 3.84 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 35405.

7. SAVINGS TO INVESTMENT RATIO (SIR) = (6 / 1G) = 3.87  
 (IF < 1 PROJECT DOES NOT QUALIFY)

\*\*\*\* Project does not qualify for ECIP funding; 4,5,6 for information only.

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): N/A

# SLOAN

## FLUSHOMETERS

### COVERS & INSIDE PARTS

Use For 1 1/4" Spud as Usual

- A-19-AC CLOSET Relief Valve
- A-19-AU URINAL Relief Valve
- A-15-A Disc
- A-156-A Diaphragm w/A-29
- A-163-A Guide Assembly
- A-36-A Inside Parts Kit for closets, service sinks, blowout and syphon jet urinals
- A-37-A Inside Parts Kit for washdown urinals
- A-38-A Retro Water Saver Kit - saves one gallon per flush for syphon jet closets

- A-72 Chrome Plated Cover
- A-71 Inside Cover

### HANDLE PARTS & ASSEMBLIES\*

- A-6 Chrome Plated handle Coupling
- B-7-A Chrome Plated Socket
- B-32 Chrome Plated Grip
- B-6-A Plunger
- C-7 Spring
- B-40 Bushing
- A-31 Handle Gasket
- B-39 Seal
- B-50-A Handle Repair Kit
- B-32-A Chrome Plated Handle Assembly also available as
- B-42-A 3" Chrome Plated Push Button Assembly
- A-156-AA Closet/Urinal washer Set (includes b-39 Seal, A-156-A Diaphragm, A-15-A Disc and A-31 Gasket)

### VACUUM BREAKER PARTS & ASSEMBLIES\*

- V-500-A & V-500-AA Chrome Plated Vacuum Breaker Assm. & Vacuum Breaker Repair Kit
- F-5-A 1 1/2" Chrome Plated Spud Coupling Assembly. Also available for 3/4", 1" and 1 1/4" spud couplings

### TAILPIECES\* ADJUSTABLE TAILPIECE

- H-551-A 2 1/16" Chrome Plated Adjustable Tailpiece Assembly
- H-550 Chrome Plated Coupling
- H-553 "O" Ring
- H-552 Lock Ring

### GROUND JOINT TAILPIECE (not shown)

- H-5 1 3/4" Chrome Plated Ground Joint Coupling
- H-8 Chrome Plated Coupling



### CONTROL STOPS\*

#### SCREWDRIVER STOPS

- H-573 1" Chrome Plated Stop Cap
- H-582 3/4" Chrome Plated Stop Cap
- H-579 1" Bonnet
- H-577 3/4" Bonnet
- H-600-A 1" or 3/4" Chrome Plated Screwdriver BAK-C Control Stop
- H-600-AG 1" or 3/4" Chrome Plated Screwdriver BAK-C Control Stop
- H-650-AG 1" Chrome Plated Screwdriver BAK-CHEK Control Stop
- H-541-A Repair Kit for 1" Screwdriver BAK-CHEK Control Stop
- H-543-A Repair Kit for 3/4" Screwdriver BAK-CHEK Control Stop

#### WHEEL HANDLE STOPS (not shown)

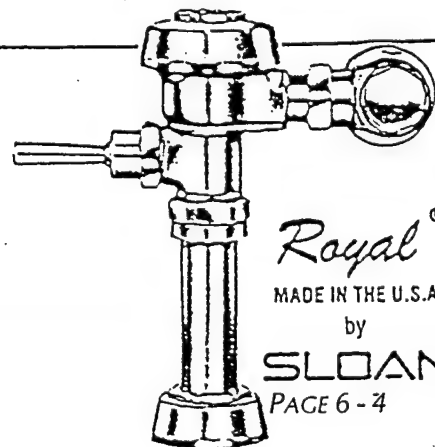
- H-36 Chrome Plated Screwdriver w/H-52 Washer
- H-575 Chrome Plated Wheel Handle
- H-556 Sound Absorbent Washer
- 3308060 Wheel Handle Repair Kit
- H-563 1" Bonnet
- H-561 3/4" Bonnet
- H-600-A 1" or 3/4" Chrome Plated Wheel Handle BAK-CHEK Control Stop
- H-650-AG 1" Chrome Plated Wheel Handle BAK-CHEK Control Stop
- H-541-A Repair Kit for 1" Wheel Handle BAK-CHEK Control Stop
- H-543-A Repair Kit for 3/4" Wheel Handle BAK-CHEK Control Stop

\*For additional information on Sloan Flushometers, parts, kits and assemblies, please refer to the Repair Parts and Maintenance Guide.



A Protective Coating that Effectively Controls Bacteria, Mold & Fungus!

ANTI-MICROBIAL  
ADDITIVE REGISTERED  
WITH THE E. P. A.





## ORDERING INSTRUCTIONS

To place an order, for your convenience and assistance, contact your local Sales Representative. A list of area representatives are on the back of this price sheet.

### Exposed Flushometers with YB Variations (Sweat Solder Adaptor)

When ordering Flushometers with the YB Variation you may obtain the kit in two ways:

1) packed with the Flushometer-

For Example:

ROYAL 110-3 YB

Order Code Number: 3010194

2) packed separate-

For Example:

ROYAL 110-3 and Sweat Solder Adaptor

Order Code Numbers: 3010193 & 3308780

### Hydraulic Flushometers

When ordering Hydraulic Flushometers the Actuator must be specified and ordered separately.

For Example:

ROYAL 910 YB

Order Code Number: 3910180

HY-33-A FW Actuator

Order Code Number: 0318001

PAGE 6 - 4

### Concealed Flushometers

When ordering Concealed Flushometers please specify the "L" Dimension and/or the Wall Thickness.

Also, please note if it is a Standard Concealed Installation or if it is to be used with a Wall Box Installation. If it is to be used with a Wall Box Installation, the Wall Box *must* be ordered separately:

\*On the Flushometer use the description only. DO NOT use the Code Number.

For Example:

\*ROYAL 152 8" WALL THICKNESS FOR WALL BOX INSTALLATION

WALL BOX ASSEMBLY

Order Code Number: 0334030

Sloan Flushometers can be furnished to provide the following flush volumes to meet the requirements of all plumbing fixtures (new and existing) and code jurisdictions:

⊗ { MUST HAVE "LOW CONSUMPTION" FIXTURE  
TO WORK PROPERLY — NOT ENOUGH WATER  
FOR CONVENTIONAL FIXTURE. }

#### Closest Flushometers

- |   |                             |          |
|---|-----------------------------|----------|
| a) Standard .....   | 4.5 GPF (Gallons per Flush) | A-36-A   |
| b) Water Saver (specify by using "-3" suffix) .....       | 3.5 GPF                     | A-38-A   |
| c) Low Consumption (specify by using "-1.5" suffix) ..... | 1.6 GPF                     | A-41-A ⊗ |

#### Urinal Flushometers (for 3/4" spud Urinals)

- |   |         |          |
|---|---------|----------|
| a) Standard .....                                       | 1.5 GPF | A-37-A   |
| b) Low Consumption (specify by using "-1" suffix) ..... | 1 GPF   | A-42-A ⊗ |

#### Urinal Flushometers (for 1 1/4" spud Urinals)

- |   |         |          |
|---|---------|----------|
| a) Standard .....                                       | 3 GPF   | A-35-A   |
| b) Water Saver (specify by using "-1.5" suffix) .....   | 1.5 GPF | A-37-A   |
| c) Low Consumption (specify by using "-1" suffix) ..... | 1 GPF   | A-42-A ⊗ |

Sloan Flushometers are designed, manufactured and tested to the requirements of ASSE 1037 and ASME/ANSI A112.19.6M

#### Allowances for Parts Omitted

Each Flushometer listed in this price sheet has its own corresponding code number. When any part is omitted in your selection the code number will change, therefore, order using the full description less any references to code number.

Note: For other parts omitted allow 1/3 of net price of part.

ITEM	ALLOW
F-101 Outlet	.25
F-20 Spud Nut	.25
F-7 Spud Flange	.15
F-7 Wall Flange	.15
Control Stops	2.20
Vacuum Breakers	2.15

PAGE 6 - 5

```
=====
Estimate:      WCO - 4          Date:      13-Mar-96
Description:    UPGRADE URINALS W/ 5.7 LPF FLUSH VALVES
Project:       LIMITED EEAP (WTR) Bid Date:
Location:      FORT BELVOIR, VA  Job #:      94013.09
Sq. footage:   PROJECT SUMMARY  City indx: Alexandria, VA
=====
```

Line #	Description	Manhours	Matl	Labor	Equipment	Sub	Total
1511410975	WCO - 4, INSTALL 5.7 LPF FLUSH VALVE REPAIR KIT , INCL D IN EXISTING URINALS					97.00 Ea.	
Unit values		1.24	27.00	26.20	0.00	0.00	53.20
Totals		120.28	\$2,619	\$2,541	\$0	\$0	\$5,160
U15 MECHANICAL		121	\$2,619	\$2,541	\$0	\$0	\$5,160

14-Mar-96

MeansData for Lotus

Page 2

```
=====
Line #      Description
-----
           Manhours  Matl    Labor  Equipment  Sub    Total
=====
```

ESTIMATE TOTAL	121	\$2,619	\$2,541	\$0	\$0	\$5,160
SALES TAX	4.50%	\$118				
MATL MARKUP	11.00%	\$288				
LABOR MARKUP	33.00%		\$839			
EQUIPT MARKUP	5.00%			\$0		
SUB MARKUP	5.00%				\$0	
TOTAL BEFORE CONTINGENC		\$3,025	\$3,380	\$0	\$0	\$6,404
CONTINGENCY	15.00%					\$961
BOND	2.50%					\$160
PROFIT	10.00%					\$640
JOB TOTAL						\$8,165.71

14-Mar-96

MeansData for Lotus

Page 3

```

=====
Estimate:      WCO - 4          Date:      13-Mar-96
Description:   UPGRADE URINALS W/ 5.7 LPF FLUSH VALVES
Project:      LIMITED EEAP (WTR) Bid Date:
Location:     FORT BELVOIR, VA  Job #:      94013.09
Sq. footage:  PROJECT SUMMARY  City indx: Alexandria, VA
=====

```

## SUMMARY

```

-----
              Manhours   Matl      Labor   Equipment   Sub      Total
=====
U15 MECHANICAL      121      $2,619    $2,541           $0          $0      $5,160
TOTAL                121      $2,619    $2,541           $0          $0      $5,160

SALES TAX           4.50%      $118
MATL MARKUP         11.00%      $288
LABOR MARKUP        33.00%           $839
EQUIPT MARKUP       5.00%           $0
SUB MARKUP          5.00%           $0

TOTAL BEFORE CONTINGENC $3,025    $3,380           $0          $0      $6,404
CONTINGENCY          15.00%           $961
BOND                  2.50%           $160
PROFIT               10.00%           $640

JOB TOTAL                                           $8,165.71

```

FY 95S EEAP FT. BELVOIR WATER CONSERVATION STUDY										1 OF 2	
CALCULATION WORK SHEET 1										DATE: 14 MAR 96	
FACILITY NO. : POSTWIDE		Function: Multiple		Operating Hours: 8 HRS/DAY		300 DAYS / YEAR					
Occupancy: 1250											
WCO Number	Existing Fixture System	Retrofitted Fixture System	Usage	Fixtures	Water Leaks						
WCO Type	Description	LPM	Hrs/Yr/Fix	Quantity	Eliminated LPY						
1											
Lav Faucets											
WCO1 TOTAL:		LPM		0	0						
2											
Misc Sinks											
WCO2 TOTAL:		LPM		0	0						
3											
Water Closets											
3A											
Water Closets											
WCO3 TOTAL:		LPM		0	0						
4											
Urinals											
WCO4 TOTAL:		LPM		97	0						
5											
Shower Heads											
USE FACTORS											
Lav Faucets	Based on (4 Min / Day Running Time / Person) / # of Fixtures										
Misc Sinks	Based on (15 Min / Day) / # of Fixtures										
Water Closets	Based on (Each Person Flushing Twice Daily) / # of Fixtures										
Urinals	Based on ( Male Bldg Occupants Flushing 3 Times Daily) / # of Fixtures										
	Assuming 50% of Bldg Occupants Are Male										

**SYSTEMS CORP**

Systems Engineering and Management Corporation, Knoxville, TN



## 7 FEMP PROJECT 4

FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.

### FEMP PROJECT 4: IMPLEMENTATION OF WCO-2FH: FAUCET AERATORS IN FAMILY HOUSING UNITS

The project consists of installing new 9.5 liters per minute (2.5 gallons per minute) faucet aerators on all kitchen sinks and lavatory faucets in 2,093 family housing units. Most sinks were found to have faucet aerators; however, a high percentage of the aerators are in deteriorating condition. The discounted savings are \$1,969,275 with an SIR of 27.88. The annual savings are \$86,518.

The project includes removal of existing aerators and installing new aerators. The construction cost is estimated to be \$70,632.

Below is a detailed index of the information included in this section.

<i>Table 7.1 WCO-2FH: Faucet Aerators in Family Housing Units</i> .....	7-2
Project LCCID Report .....	7-3
Catalog Cut Sheet .....	7-4
Project Cost Estimate .....	7-8
Project Calculation Sheets .....	7-11

Table 7.1	
WCO-2FH: FAUCET AERATORS IN FAMILY HOUSING UNITS	
FAMILY HOUSING UNIT NO.	NO. OF UNITS MODELED
1	61
150	76
417 B	54
455 B	25
522 A	148
810 C	92
902 C	135
924 B	135
1533 A	244
1641 B	189
1702 F	11
1703 D	9
1723 A1	426
2785 A	444
T-468	44
TOTAL	2093



LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: BVRFEMP4  
LCCID FY95 (92)

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FT BELVOIR REGION NOS. 3 CENSUS: 3

PROJECT NO. & TITLE: 94013.09 FT BELVOIR WATER CONSERVATION

FISCAL YEAR 1996 DISCRETE PORTION NAME: INSTALL AERATORS FAM HSG LAV FAU

ANALYSIS DATE: 06-25-96 ECONOMIC LIFE 20 YEARS PREPARED BY: JWD

1. INVESTMENT

A. CONSTRUCTION COST	\$	63064.	
B. SIOH	\$	3784.	
C. DESIGN COST	\$	3784.	
D. TOTAL COST (1A+1B+1C)	\$	70632.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.	
F. PUBLIC UTILITY COMPANY REBATE	\$	0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		70632.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1994

FUEL	UNIT COST \$/ MWH (1)	SAVINGS MWH/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT	\$ 47.30	956.	\$ 45218.	15.08	\$ 681890.
B. DIST	\$ .00	0.	\$ 0.	18.57	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	21.02	\$ 0.
D. NAT G	\$ .00	0.	\$ 0.	18.58	\$ 0.
E. COAL	\$ .00	0.	\$ 0.	16.83	\$ 0.
F. PPG	\$ .00	0.	\$ 0.	17.38	\$ 0.
M. DEMAND SAVINGS			\$ 0.	14.88	\$ 0.
N. TOTAL		956.	\$ 45218.		\$ 681890.

3. NON ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)

(1) DISCOUNT FACTOR (TABLE A)	14.88	\$ 86518.
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 1287386.

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS (+) COST (-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS (+) / COST (-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2+3Bd4) \$ 1287386.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS\ ECONOMIC\ LIFE))$  \$ 131736.

5. SIMPLE PAYBACK PERIOD (1G/4) .54 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 1969275.

7. SAVINGS TO INVESTMENT RATIO (SIR) = (6 / 1G) = 27.88  
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 21.65 %



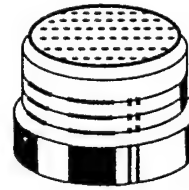
## Specifications

### DESCRIPTION

- Chrome plated brass and synthetic materials
- Spanner wrench included

### WARRANTY

- Warranted for one year against material or manufacturing defects



**SANI-STREAM®**  
**Aerator, Male**  
**Vandal Resistant**  
**2.5 gpm**  
**Model 52618**

LAVATORY FAUCETS

**15/16" X 27 MALE THREAD**

### CRITICAL DIMENSIONS

(DO NOT SCALE)



## FLOW REGULATED OUTLETS

To fit most faucets manufactured by the plumbing industry. Adapters supplied have hex socket to aid in fastening flow control securely to faucet.

## IMPORTANT NOTE:

When ordering specify flow rate desired by adding suffix as noted in table below. All flow controls are color coded.



### B-199-1-F. Flow Control Aerator

Non-splash aerator provides flow regulated supply of water for washing etc. yet reduces consumption of water to pre-determined quantities.  $\frac{5}{16}$ "-27 female aerator thread.



### B-199-6-F.

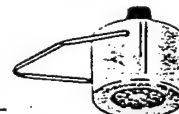
**Vandal Resistant Flow Control Aerator**  
Non-splash aerator attached with tool supplied. Removable only with tool otherwise spins freely. Provides an adequate supply of water yet reduces consumption of water to pre-determined quantities.  $\frac{5}{16}$ "-27 female aerator thread.



### B-199-12-F.

**Vandal Resistant Flow Control Aerator with Anti-Hose Ring**

Non-splash aerator attached with tool supplied. Removable only with tool otherwise spins freely. Unit has protruding ring to prevent attaching hose to aerator. Provides an adequate supply of water yet reduces consumption of water to pre-determined quantities.  $\frac{5}{16}$ "-27 female aerator thread fits most nozzles and many goosenecks.



### B-199-16-F.

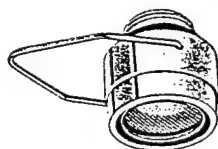
**Vandal Resistant Flow Control with Non-Aerated Spray**

Unit provides a non-aerated spray pattern which supplies adequate water for washing etc. Unique design produces pre-determined flow with a moderate velocity at low water usage. Installed with tool supplied, unit spins freely and can be removed only with tool. Available with 0.7 G.P.M. and 0.9 G.P.M. flow controls only.  $\frac{5}{16}$ "-27 female aerator thread.



### B-199-2-F.

Same as B-199-1-F. except has  $\frac{3}{8}$ " IPS male thread adapter.



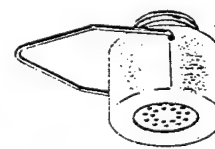
### B-199-7-F.

Same as B-199-6-F. except has  $\frac{3}{8}$ " IPS male thread adapter.



### B-199-13-F.

Same as B-199-12-F. except has  $\frac{3}{8}$ " IPS male thread adapter.



### B-199-17-F.

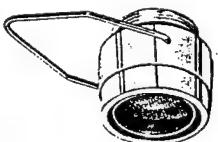
Same as B-199-16-F. except has  $\frac{3}{8}$ " IPS male thread adapter.

**LAVATORY  
2.5 GPM**



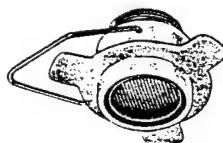
### B-199-3-F.

Same as B-199-1-F. except has  $\frac{13}{16}$ "-27 male thread adapter.



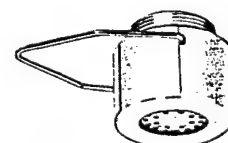
### B-199-8-F.

Same as B-199-6-F. except has  $\frac{13}{16}$ "-27 male thread adapter.



### B-199-14-F.

Same as B-199-12-F. except has  $\frac{13}{16}$ "-27 male thread adapter.



### B-199-18-F.

Same as B-199-16-F. except has  $\frac{13}{16}$ "-27 male thread adapter.

### B-198-F.

#### Low Splash Serrated Tip

Serrated tip with flow control provides smooth stream of water but minimizes splash associated with serrated hose ends. Use of flow controls above 0.5 G.P.M. will be less effective in reducing splash, however will still cut water consumption to a pre-determined rate.  $\frac{3}{8}$ " IPS male thread. Accepts plastic or rubber tubing up to  $\frac{1}{2}$ " inside diameter.

TABLE			
FLOW (GPM $\pm$ 15%)	SUFFIX	MODELS BEST USED ON	COLOR CODE
0.25	F-03	Used on B-198-F. only	No color
0.40	F-05		Tan
0.70	F-07		Green
0.90	F-10	All Models shown	Grey
1.20	F-12		Orange
1.40	F-15		Purple
2.00	F-20	Can be used on all models shown except B-199-16-F, B-199-17-F, B-199-18-F, and B-199-19-F.	Yellow
2.50	F-25		White
3.00	F-30		Blue

#### To order:

Select flow desired then add suffix to Model Number.

For Example: B-199-2-F-15

#### \*Note:

Painted mark on each flow control within the assembly indicates flow of unit.



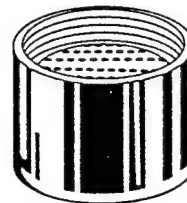
## Specifications

### DESCRIPTION

- Chrome plated brass and synthetic materials
- Spanner wrench included

### WARRANTY

- Warranted for one year against material or manufacturing defects



**SANI-STREAM®**  
Aerator, Female  
Vandal Resistant  
2.5 gpm  
Model 52619

KITCHEN FAUCETS

55/64" X 27 MALE THREAD

### CRITICAL DIMENSIONS

(DO NOT SCALE)

PAGE 7-6



## FLOW REGULATED OUTLETS

To fit most faucets manufactured by the plumbing industry. Adapters supplied have hex socket to aid in fastening flow control securely to faucet.

## IMPORTANT NOTE:

When ordering specify flow rate desired by adding suffix as noted in table below. All flow controls are color coded.

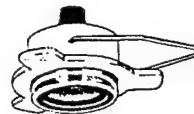
# 2.5 GPM KITCHEN



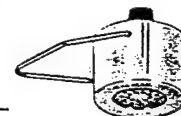
**B-199-1-F. Flow Control Aerator**  
Non-splash aerator provides flow regulated supply of water for washing etc. yet reduces consumption of water to pre-determined quantities.  $\frac{5}{16}$ "-27 female aerator thread.



**B-199-6-F. Vandal Resistant Flow Control Aerator**  
Non-splash aerator attached with tool supplied. Removable only with tool otherwise spins freely. Provides an adequate supply of water yet reduces consumption of water to pre-determined quantities.  $\frac{5}{16}$ "-27 female aerator thread.



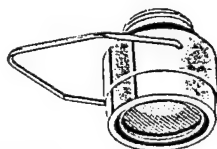
**B-199-12-F. Vandal Resistant Flow Control Aerator with Anti-Hose Ring**  
Non-splash aerator attached with tool supplied. Removable only with tool otherwise spins freely. Unit has protruding ring to prevent attaching hose to aerator. Provides an adequate supply of water yet reduces consumption of water to pre-determined quantities.  $\frac{5}{16}$ "-27 female aerator thread fits most nozzles and many goosenecks.



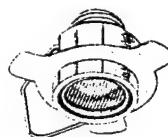
**B-199-16-F. Vandal Resistant Flow Control with Non-Aerated Spray**  
Unit provides a non-aerated spray pattern which supplies adequate water for washing etc. Unique design produces pre-determined flow with a moderate velocity at low water usage. Installed with tool supplied, unit spins freely and can be removed only with tool. Available with 0.7 G.P.M. and 0.9 G.P.M. flow controls only.  $\frac{5}{16}$ "-27 female aerator thread.



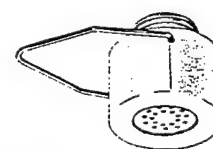
**B-199-2-F.**  
Same as B-199-1-F. except has  $\frac{3}{8}$ " IPS male thread adapter.



**B-199-7-F.**  
Same as B-199-6-F. except has  $\frac{3}{8}$ " IPS male thread adapter.



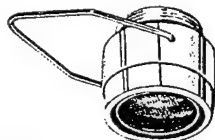
**B-199-13-F.**  
Same as B-199-12-F. except has  $\frac{3}{8}$ " IPS male thread adapter.



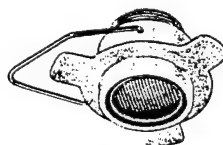
**B-199-17-F.**  
Same as B-199-16-F. except has  $\frac{3}{8}$ " IPS male thread adapter.



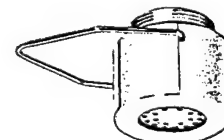
**B-199-3-F.**  
Same as B-199-1-F. except has  $\frac{13}{16}$ "-27 male thread adapter.



**B-199-8-F.**  
Same as B-199-6-F. except has  $\frac{13}{16}$ "-27 male thread adapter.



**B-199-14-F.**  
Same as B-199-12-F. except has  $\frac{13}{16}$ "-27 male thread adapter.



**B-199-18-F.**  
Same as B-199-16-F. except has  $\frac{13}{16}$ "-27 male thread adapter.

### B-198-F. Low Splash Serrated Tip

Serrated tip with flow control provides smooth stream of water but minimizes splash associated with serrated hose ends. Use of flow controls above 0.5 G.P.M. will be less effective in reducing splash, however will still cut water consumption to a pre-determined rate.  $\frac{3}{8}$ " IPS male thread. Accepts plastic or rubber tubing up to  $\frac{1}{2}$ " inside diameter.

TABLE

FLOW (GPM $\pm$ 15%)	SUFFIX	MODELS BEST USED ON	COLOR CODE
0.25	F-03	Used on B-198-F. only	No color
0.40	F-05		Tan
0.70	F-07		Green
0.90	F-10	All Models shown	Grey
1.20	F-12		Orange
1.40	F-15		Purple
2.00	F-20	Can be used on all models shown except B-199-16-F, B-199-17-F, B-199-18-F, and B-199-19-F.	Yellow
2.50	F-25		White
3.00	F-30		Blue

To order:  
Select flow desired then add suffix to Model Number.  
For Example: B-199-2-F-15

\*Note:  
Painted mark on each flow control within the assembly indicates flow of unit.

```

=====
Estimate:      WCO - 2FH          Date:      14-Mar-96
Description:    INSTALL AERATORS  - FAMILY HOUSING
Project:       LIMITED EEAP (WTR) Bid Date:
Location:      FORT BELVOIR, VA  Job #:      94013.09
Sq. footage:   PROJECT SUMMARY   City indx: Alexandria, VA
=====

```

Line #	Description	Manhours	Matl	Labor	Equipment	Sub	Total
1511412805	WCO - 2FH, INSTALL AERATOR, LAVATORY FAUCET						
						6057.00 Ea.	
Unit values		0.25	1.00	5.27	0.00	0.00	6.27
Totals		1514.25	\$6,057	\$31,929	\$0	\$0	\$37,986
U15 MECHANICAL	1515	\$6,057	\$31,929	\$0	\$0	\$37,986	

14-Mar-96

MeansData for Lotus

Page 2

```
=====
Line #      Description
-----
      Manhours   Matl    Labor   Equipment   Sub    Total
=====
```

ESTIMATE TOTAL	1515	\$6,057	\$31,929	\$0	\$0	\$37,986
SALES TAX	4.50%	\$273				
MATL MARKUP	11.00%	\$666				
LABOR MARKUP	33.00%		\$10,537			
EQUIPT MARKUP	5.00%			\$0		
SUB MARKUP	5.00%				\$0	
TOTAL BEFORE CONTINGENC		\$6,996	\$42,466	\$0	\$0	\$49,461
CONTINGENCY	10.00%					\$4,946
BOND	2.50%					\$1,237
PROFIT	15.00%					\$7,419
JOB TOTAL						\$63,063

```

=====
Estimate:      WCO - 2FH          Date:      14-Mar-96
Description:   INSTALL AERATORS  - FAMILY HOUSING
Project:       LIMITED EEAP (WTR) Bid Date:
Location:      FORT BELVOIR, VA  Job #:      94013.09
Sq. footage:   PROJECT SUMMARY   City indx: Alexandria, VA
=====

```

## SUMMARY

```

-----
Manhours  Matl    Labor  Equipment  Sub    Total
=====
U15 MECHANICAL  1515    $6,057    $31,929        $0        $0    $37,986
TOTAL          1515    $6,057    $31,929        $0        $0    $37,986

SALES TAX      4.50%      $273
MATL MARKUP    11.00%     $666
LABOR MARKUP   33.00%
EQUIPT MARKUP  5.00%
SUB MARKUP     5.00%

TOTAL BEFORE CONTINGENC  $6,996    $42,466        $0        $0    $49,461
CONTINGENCY      10.00%
BOND              2.50%
PROFIT           15.00%
JOB TOTAL                                     $63,063

```



FY 95S EEAP FT. BELVOIR WATER CONSERVATION STUDY										1 OF 2	
CALCULATION WORK SHEET 1										DATE: 14 MAR 96	
FACILITY NO.:		POSTWIDE		FUNCTION:		FAMILY HOUSING					
		(Assumes Average Family of Four in each of 2093 Units)									
Avg Occupancy:		FAMILY - 3 BDRM / 2 BATH		Operating Hours:		24 HRS - 365 DAYS / YR					
ECO Number ECO Type	Existing Fixture System Description	LPM	Retrofited Fixture System Description	LPM	Usage HRS/YR	Fixtures Quantity	Water Leaks Eliminated LPY				
2 FH AERATORS	FAUCETS	18.9	INSTALL AERATOR	9.5	34	6057					
ECO2 FH TOTAL:		LPF		LPM	#FL/YR	6057	0				
3 FH WATER CLOSETS											
ECO3 FH TOTAL:		LPM		LPM	HRS/YR	0	0				
5 FH SHOWERS											
ECO5 FH TOTAL:						0	0				
USE FACTORS											
AERATORS	Based on (4 Min / Day Running Time / Person) / # of Fixtures										
WATER CLOSETS	Based on (6 Flushes / Person / Day) / # of Fixtures										

**SYSTEMS CORP**

Systems Engineering and Management Corporation, Knoxville, TN

FY95S EEAP FT. BELVOIR WATER CONSERVATION STUDY										2 OF 2	
CALCULATION WORK SHEET 2											
FACILITY NO. : POSTWIDE		Wtr/Swg Rate: 0.74 \$/KL		Energy Rate: 0.0473 \$/KWH							
		Gas Rate: 18.19 \$/MWH		Demand Rate: \$/KW							
ECO Number ECO Type	Annual Water Saving LPY	Annual Energy Savings		WATER Dollar Saving	Energy Dollar Saving	Total Dollars Invested					
		ELEC KW	ELEC KWH				GAS MWH				
2 FH AERATORS	116,604,937		955986		\$86,520.86	\$45,218.14	\$63,064.10				
ECO2 FH TOTAL:	116,604,937		955,986	0	\$86,521	\$45,218	\$63,064				
3 FH WATER CLOSETS											
ECO3 FH TOTAL:	0		0	0	\$0.00	\$0.00	\$0.00				
5 FH SHOWERS											
ECO5 FH TOTAL:	0				\$0.00	\$0.00	\$0.00				

**SYSTEMS CORP**

### FEMP PROJECT 5: IMPLEMENTATION OF WCO-3FH: WATER CLOSET RETROFITS IN FAMILY HOUSING UNITS

This project consists of replacing the existing flapper valves in the existing tank-type water closets with new early closing flapper valves. This project will reduce the volume of water for flushing from 18.9 liters per flush (5.0 gallons per flush) to approximately 11.4 liters per flush (3.0 gallons per flush). This project involves all of the 2,093 family housing units located on the Post. The discounted savings are \$1,288,043 with an SIR of 13.18. The annual savings are \$96,218.

This project includes removing the existing flapper valves and installing new early closing flapper valves. The construction cost is estimated to be \$97,746.

Below is a detailed index of the information included in this section.

<i>Table 8.1 WCO-3FH: Water Closet Retrofits in Family Housing Units</i> .....	8-2
Project LCCID Report .....	8-3
Catalog Cut Sheet .....	8-4
Project Cost Estimate .....	8-11
Project Calculation Sheets .....	8-14

Table 8.1  
WCO-3FH: WATER CLOSET RETROFITS IN  
FAMILY HOUSING UNITS

FAMILY HOUSING UNIT NO.	NO. OF UNITS MODELED
1	61
150	76
417 B	54
455 B	25
522 A	148
810 C	92
902 C	135
924 B	135
1533 A	244
1641 B	189
1702 F	11
1703 D	9
1723 A1	426
2785	444
T-468	44
TOTAL	2093

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: BVRFEMP5

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)      LCCID FY95 (92)

INSTALLATION & LOCATION: FT BELVOIR      REGION NOS. 3      CENSUS: 3

PROJECT NO. & TITLE: 94013.09      FT BELVOIR WATER CONSERVATION

FISCAL YEAR 1996      DISCRETE PORTION NAME: INSTALL EARLY CLSING FLAPPER FAM

ANALYSIS DATE: 03-14-96      ECONOMIC LIFE 20 YEARS      PREPARED BY: JWD

1. INVESTMENT

A. CONSTRUCTION COST	\$	87273.	
B. SIOH	\$	5236.	
C. DESIGN COST	\$	5236.	
D. TOTAL COST (1A+1B+1C)	\$	97746.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.	
F. PUBLIC UTILITY COMPANY REBATE	\$	0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		97746.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1994					
FUEL	UNIT COST \$/ MWH(1)	SAVINGS MWH/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 47.30	0.	\$ 0.	15.08	\$ 0.
B. DIST	\$ .00	0.	\$ 0.	18.57	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	21.02	\$ 0.
D. NAT G	\$ .00	0.	\$ 0.	18.58	\$ 0.
E. COAL	\$ .00	0.	\$ 0.	16.83	\$ 0.
F. PPG	\$ .00	0.	\$ 0.	17.38	\$ 0.
M. DEMAND SAVINGS			\$ 0.	14.88	\$ 0.
N. TOTAL		0.	\$ 0.		\$ 0.

3. NON ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)		\$ 96218.
(1) DISCOUNT FACTOR (TABLE A)	14.88	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 1431730.

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS (+) COST (-)	YR OC	DISCNT FACTR	DISCOUNTED SAVINGS (+) / COST (-) (4)
1. REPLACEMENT	\$ -97746.	7	.81	-79174.
2. REPLACEMENT 2	\$ -97746.	14	.66	-64512.

d. TOTAL	\$-195492.	-143687.
----------	------------	----------

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2+3Bd4) \$ 1288043.

4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE)) \$ 86444.

5. SIMPLE PAYBACK PERIOD (1G/4) 1.13 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 1288043.

7. SAVINGS TO INVESTMENT RATIO (SIR) = (6 / 1G) = 13.18  
(IF < 1 PROJECT DOES NOT QUALIFY)

\*\*\*\* Project does not qualify for ECIP funding; 4,5,6 for information only.

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): N/A

## FRUGAL FLUSH. WATER-SAVING REPLACEMENT PRODUCTS

1. The Frugal Flush RETROFLAPPER™ water-saving replacement flapper (for retrofitting older 3.5, 5 and 7 gallon toilets)
2. The Frugal Flush FLAPPER ADAPTER (for retrofitting disc-cylinder flush valves)
3. The Frugal Flush UNIVERSAL 1.6gpf replacement flapper (for 1.6gpf low-consumption toilets)

Contact:

Frugal Technologies, Inc.  
1209 E. Washington, #4  
Phoenix, AZ 85034  
(602) 253-6275

# FRUGAL FLUSH<sup>®</sup> SAVES 1/2 THE WATER!

## Product Features:

- Flapper seal is made of flexible thermoplastic rubber for superior resistance to mineral buildup
- Rigid cone is made of acetal resins to prevent any cone deformation or collapse
- Adjustable end cap is made of flexible vinyl which allows easy adjustment for optimum water savings.
- FRUGAL FLUSH<sup>®</sup> will fit most any flapper valve toilet. Adapters are provided for easy installation for American Standard and Douglas valves.

## Product Benefits:

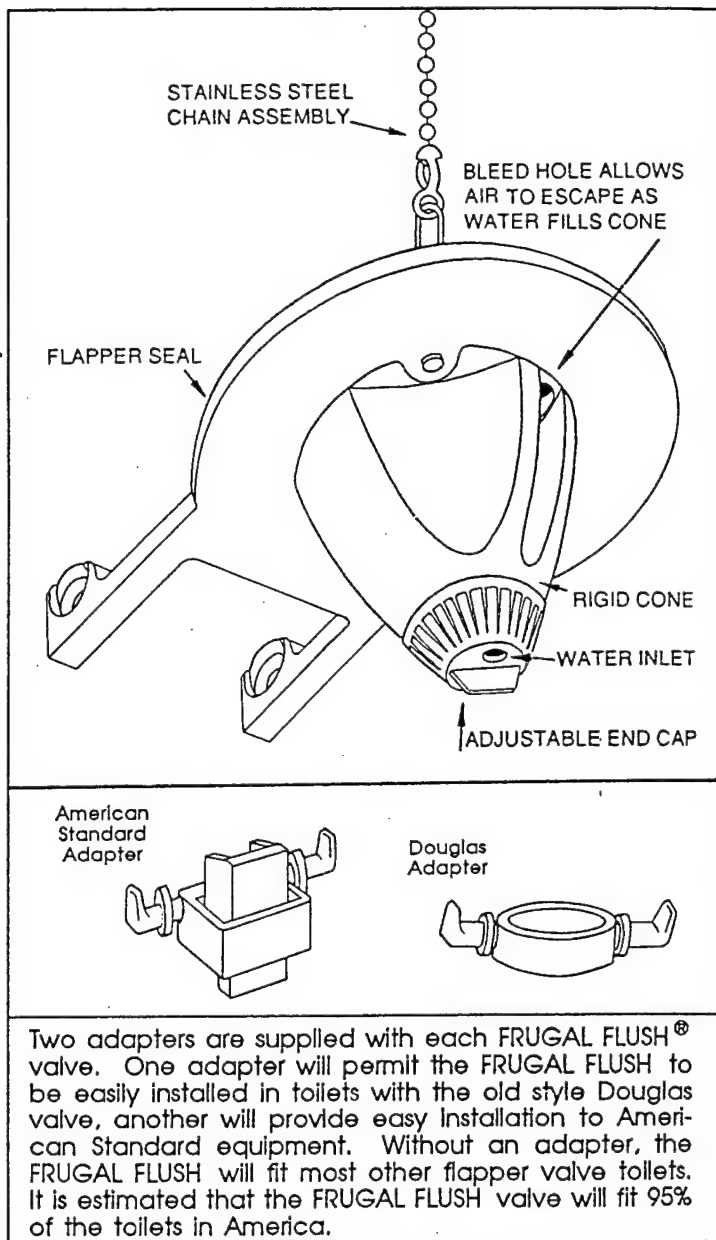
- No tools are required for installation
- Uses the toilet's original design of head pressure and scouring action
- No toilet modifications are required
- Reduces water consumption
- Saves money on reduced water and sewer bills
- Fits most 7, 5, and 3.5 gallon toilets
- Made of scale resistant materials which resists hard water minerals
- User enjoys same flushing power, and lifestyle is unaffected because valve is a passive water conservation device

## Minimum Order:

One dozen valves

## Pricing (FOB Factory):

Quotes provided on request



## INDEX

Introduction .....	Page 1
Frugal Flush RETROFLAPPER™ water-saving replacement flapper .....	3
Frugal Flush FLAPPER ADAPTER for disc-cylinder flush valve .....	5
Frugal Flush UNIVERSAL 1.6gpf replacement flapper .....	6
Savings .....	7
Summary .....	8



## INTRODUCTION

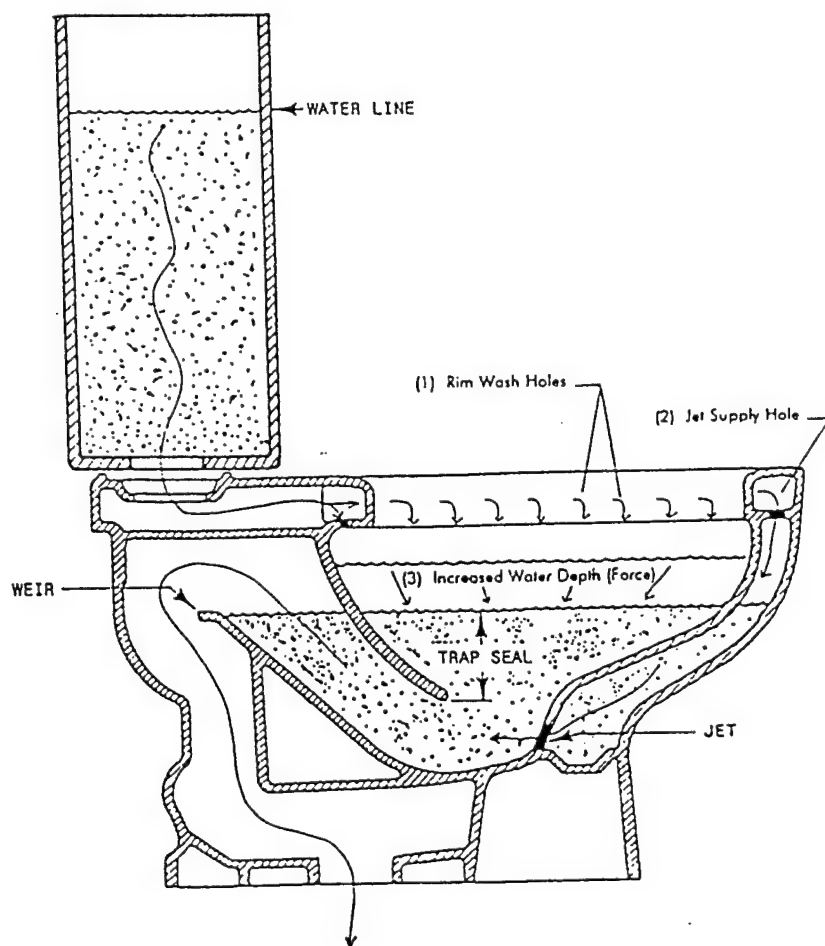
This booklet will introduce you to the Frugal Flush® Water-Saving Replacement Products: 1) Frugal Flush RETROFLAPPER, 2) Frugal Flush FLAPPER ADAPTER for American Standard disc-cylinder flush valves and, 3) Frugal Flush UNIVERSAL 1.6gpf replacement flapper.

You will discover the thinking and determination of Frugal Flush personnel which have led to the development of the Company's products. You will learn how the products operate, observe their simplicity of design and come to appreciate their enormous potential to save water without compromising the ability to flush liquid or solid waste. Additionally, you will learn why major toilet manufacturers are using the "Frugal Technology" as the early-closure system for many of their 1.6gpf (gallons per flush) low-consumption tank toilets.

To understand the Frugal Products and why they are able to save water, it is necessary to understand how a toilet works.

Figure 1 illustrates the flow of water from a toilet tank through the bowl. You'll notice the water flow around the rim of the bowl where it enters from the "rim wash" holes (1) under the rim and (2) from a larger hole which supplies the jet force to enhance siphonic action. Water depth in the bowl increases, adding additional force needed to create the sudden surge to bring about siphonic action, the method by which solids and liquids are drawn or pulled to the sewer.

Figure 1



## FRUGAL FLUSH RETROFLAPPER™

The Frugal Flush RETROFLAPPER is a replacement water-saving flapper which will retrofit your 3.5, 5 or 7 gallon tank toilet to save 30-50% of the water required for a complete flush cycle. This product saves water and money without sacrificing the ability to flush liquids or solids. It is truly quite simple.

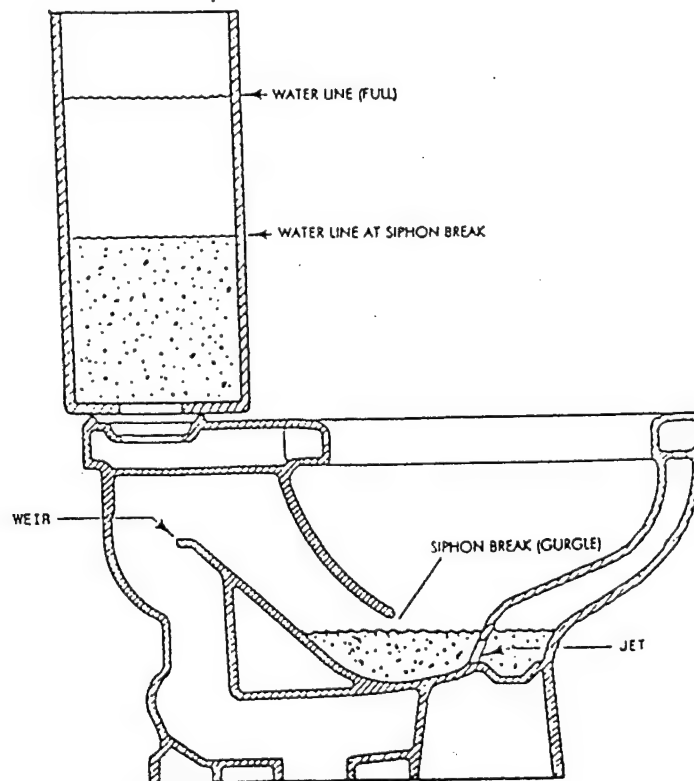
After considering that the first half of the water used in a flush is driven by more force and power than the last half, it became apparent that the only real purpose for the upper half of the water is to provide additional force and surge to the lower half. Therefore, the Frugal Flush inventors designed a flapper which saves water and still maintains the necessary head pressure, surge and hydraulic action. The flapper has an air-bleed hole positioned at the top edge of the cone and an adjustable end cap on the bottom end of the cone. This end cap selects, by rotation, one of five gauged holes through which water will flow into the air chamber of the cone when the flapper is submerged to create negative buoyancy at a precise point causing the flapper to close (early-closure).

The purpose of generating the necessary head pressure, surge and hydraulic action during every flush is to insure adequate siphonic action. Siphonic action is the method by which all tank type toilets extract waste. Without siphonic action, the user will only dilute the waste water.

The Frugal Flush RETROFLAPPERS convert older 3.5, 5 and 7 gallons toilets to use much less water per flush by *utilizing a full tank of water but causing the flapper valve to close at a point which will cause a full flush without discharging all the tank water*. Frugal Flush RETROFLAPPERS are not gimmicks - they are simply flappers that close early. The simplicity of the design and functionality of the toilet is preserved while conserving the maximum amount of water.

Siphonic action and waste removal occur between the surge (which creates the siphonic action) and the "siphon break" (which creates the "gurgle"). When there is a good gurgle, there is good siphonic action. The siphon break occurs when the contents of the bowl have been evacuated but before all the water has been discharged from the tank as Figure 3 illustrates. This is the time to close off the flow of water from the tank because no additional tank water is required to accomplish the flush.

Figure 3



## PRODUCT FEATURES

The Frugal Flush flapper's adjustable end cap may be rotated to select one of five gauged hole openings to allow the user to optimize water savings and still allow solids to be flushed. This accommodates variables such as tank size, atmospheric pressure as a result of altitude above sea level, and user preference so that a complete flush is accomplished.

The Frugal Flush Water-Saving Replacement Flapper is unlike any water-saving device available on the market today. Unlike water-saving shower heads, the Frugal Flush flapper valve is a passive water-saving device. Once installed, the consumer will not notice any difference in a flush but will enjoy reduced water and sewage bills.

The Frugal Flush flapper is a replacement product that can provide a complete flush while saving up to 50% of the water required for a complete flush cycle.

The Frugal Flush flapper works with the HEAD PRESSURE and SCOURING ACTION originally designed into the toilet.

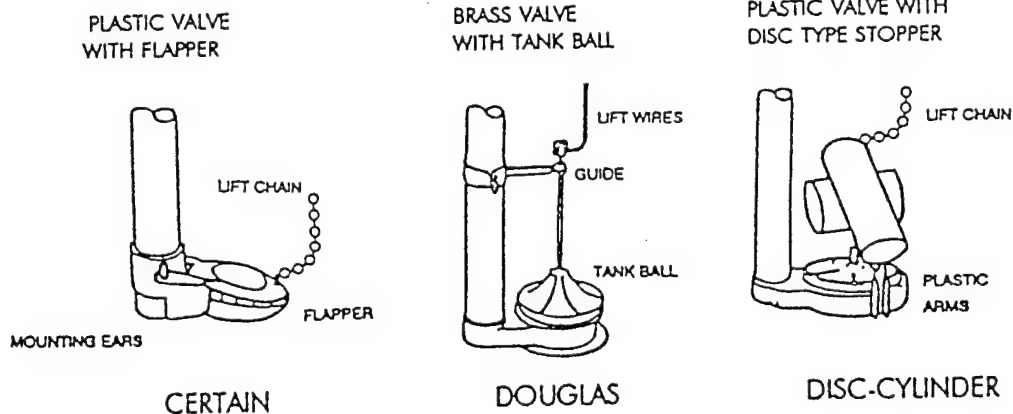
## PRODUCT BENEFITS:

- Reduces water consumption and cost
- Reduces sewage use and cost
- Made of special scale resistant materials which resists hard water minerals
- Adjustable for maximum water savings and flushing power
- Maintains a higher average head pressure than conventional flappers
- Fits most 3.5, 5 and 7 gallon tank toilets
- Requires no tools for installation
- Requires no cutting or toilet modification
- Reduces (or eliminates) bowl overflow

## FLUSH VALVES and ADAPTERS:

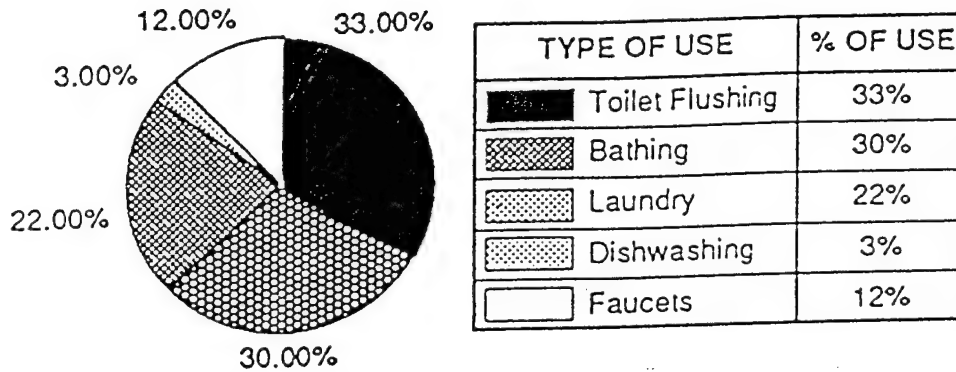
The three flush valves illustrated below are used in over 90% of the 163,000,000 tank toilets in the United States. Half of these use a CERTAIN flush valve; the other half use the DOUGLAS or DISC-CYLINDER flush valves. The Frugal Flush Water-Saving Replacement Flapper easily buttons on to the CERTAIN flush valve. Adapters for the DOUGLAS valve and a patented adapter for use on a disc-cylinder flush valve are available.

### Major Flush Valves Used In Tank Toilets



## SAVINGS

Toilets are the greatest water users and wasters within the home. According to American Waterworks Association 1987 statistics, it is estimated that the breakdown of household fresh water usage for non-conserving homes is:



Frugal Flush can reduce overall household water usage substantially. The typical family of four uses 9,276 gallons of fresh water per month or 111,312 gallons per year. Saving 1 1/2 gallons per flush will save 11,497 gallons or 10% per year. Three (3) gallons per flush will save 22,994 gallons or 20% per year. The chart below will estimate your dollar savings per year based upon your water saved per flush and your water/sewer costs. *With these savings the FRUGAL FLUSH RETROFLAPPER should pay for itself within a few months.*

ANNUAL SAVINGS ON WATER/SEWAGE CHARGES*			
RATES PER 1000 GALLONS	WATER SAVED PER FLUSH		
	1 1/2 GALLONS	2 1/2 GALLONS	3 1/2 GALLONS
\$3.00	\$34.45	\$57.41	\$80.38
\$4.00	\$45.93	\$76.55	\$107.17
\$5.00	\$57.41	\$95.69	\$133.96
\$6.00	\$68.90	\$114.83	\$160.76

\*Based on an average family of four, flushing 21 times a day, 365 days a year.

```

=====
Estimate:      WCO - 3FH          Date:      14-Mar-96
Description:   INSTALL EARLY CLOSING FLAPPER FOR WATER CLOSETS - FAMILY H
Project:      LIMITED EEAP (WTR) Bid Date:
Location:     FORT BELVOIR, VA   Job #:      94013.09
Sq. footage:  PROJECT SUMMARY   City indx: Alexandria, VA
=====

```

Line #	Description	Manhours	Matl	Labor	Equipment	Sub	Total
1521766500	WCO - 3 FH, INSTALL EARLY CLOSING FLAPPER IN EXISTING WATER CLOSET					3964.00 Ea.	
Unit values		0.50	2.81	10.54	0.00	0.00	13.35
Totals		1982.00	\$11,139	\$41,792	\$0	\$0	\$52,931
U15 MECHANICAL		1982	\$11,139	\$41,792	\$0	\$0	\$52,931

```
=====
Line #      Description
-----
            Manhours   Matl      Labor   Equipment   Sub      Total
=====

ESTIMATE TOTAL    1982    $11,139    $41,792           $0          $0    $52,931

SALES TAX          4.50%           $501
MATL MARKUP        11.00%        $1,225
LABOR MARKUP       33.00%           $13,791
EQUIPT MARKUP      5.00%           $0
SUB MARKUP         5.00%           $0

TOTAL BEFORE CONTINGENC $12,866    $55,583    $0          $0    $68,449
CONTINGENCY        10.00%           $6,845
BOND               2.50%           $1,711
PROFIT             15.00%          $10,267

JOB TOTAL                                $87,272
=====
```

```

=====
Estimate:      WCO - 3FH          Date:      14-Mar-96
Description:   INSTALL EARLY CLOSING FLAPPER FOR WATER CLOSETS - FAMILY H
Project:      LIMITED EEAP (WTR) Bid Date:
Location:     FORT BELVOIR, VA  Job #:      94013.09
Sq. footage:  PROJECT SUMMARY   City indx: Alexandria, VA
=====

```

## SUMMARY

```

-----
Manhours  Matl  Labor  Equipment  Sub  Total
=====
U15 MECHANICAL  1982  $11,139  $41,792          $0  $0  $52,931
TOTAL          1982  $11,139  $41,792          $0  $0  $52,931

SALES TAX      4.50%      $501
MATL MARKUP    11.00%     $1,225
LABOR MARKUP   33.00%          $13,791
EQUIPT MARKUP  5.00%          $0
SUB MARKUP     5.00%          $0

TOTAL BEFORE CONTINGENC  $12,866  $55,583  $0  $0  $68,449
CONTINGENCY      10.00%          $6,845
BOND              2.50%          $1,711
PROFIT           15.00%          $10,267

JOB TOTAL                                $87,272

```

FY 95S EEAP FT. BELVOIR WATER CONSERVATION STUDY										1 OF 2	
CALCULATION WORK SHEET 1										DATE: 14 MAR 96	
FACILITY NO.:		POSTWIDE		FUNCTION:		FAMILY HOUSING					
		(Assumes Average Family of Four in each of 2093 Units)									
Avg Occupancy:		FAMILY - 3 BDRM / 2 BATH		Operating Hours:		24 HRS - 365 DAYS / YR					
ECO Number ECO Type	Existing Fixture System		Retrofitted Fixture System		Usage HRS/YR	Fixtures Quantity	Water Leaks Eliminated LPY				
	Description	LPM	Description	LPM							
2 FH AERATORS											
ECO2 FH TOTAL:		LPF		LPF	#FL/YR	0	0				
3 FH WATER CLOSETS			INSTALL EARLY CLOSING FLAPPER								
	AMERICAN STANDARD	13.2		5.7	4732	3964					
ECO3 FH TOTAL:		LPM		LPM	HRS/YR	3964	0				
5 FH SHOWERS											
ECO5 FH TOTAL:						0	0				
USE FACTORS											
AERATORS	Based on (4 Min / Day Running Time / Person) / # of Fixtures										
WATER CLOSETS	Based on (6 Flushes / Person / Day) / # of Fixtures										

**SYSTEMS CORP**

Systems Engineering and Management Corporation, Knoxville, TN



FY95S EEAP FT. BELVOIR WATER CONSERVATION STUDY 2 OF 2

CALCULATION WORK SHEET 2

FACILITY NO.: POSTWIDE Wtr/Swng Rate: 0.74 \$/KL Energy Rate: 0.0473 \$/KWH

Gas Rate: 18.19 \$/MWH Demand Rate: \$/KW

ECO Number ECO Type	Annual Water Saving LPY	Annual Energy Savings		WATER Dollar Saving	Total Dollar Saving	Total Dollars Invested
		ELEC KW	ELEC KWH			
2 FH AERATORS						
ECO2 FH TOTAL:	0	0	0	\$0.00	\$0.00	\$0.00
3 FH WATER CLOSETS	140,670,171			\$104,377.27	\$104,377.27	\$87,272.88
ECO3 FH TOTAL:	140,670,171	0	0	\$104,377	\$104,377	\$87,273
5 FH SHOWERS						
ECO5 FH TOTAL:	0			\$0.00	\$0.00	\$0.00

SYSTEMS CORP

FEMP PROJECT 6: IMPLEMENTATION OF WCO-13: WATER EFFICIENT  
EQUIPMENT UPGRADES AND STEAM TRAP REPLACEMENT

The project consists of the replacement of 111 steam traps on the steam distribution system serving Buildings 332 and 1422, central heating plants. The existing float and thermostatic steam traps have failed. The failed steam traps are allowing live, high pressure steam to pass in an uncontrolled manner through the steam traps into the condensate system where it is vented to the atmosphere. The failed steam traps are causing an annual energy loss of 5,174 MWH per year and 32.7 million liters per year (8.64 million gallons of water per year). The discounted savings are \$686,153 with an SIR of 17.84. Annual savings are \$101,375.

The project includes removal of existing steam traps, installation of new steam traps, stainless steel identification tags for the new steam traps, steam trap database, steam trap testing equipment and operating and maintenance manuals and training. The construction cost is estimated to be \$38,469.

Below is a detailed index of the information included in this section:

Project LCCID Report .....	9-2
Catalog Cut Sheet .....	9-3
Project Cost Estimate.....	9-4
Project Calculation Sheets .....	9-8

LIFE CYCLE COST ANALYSIS SUMMARY

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)      STUDY: BVRFEMP6  
 INSTALLATION & LOCATION: FT BELVOIR      REGION NOS. 3      LCCID FY95 (92)  
 PROJECT NO. & TITLE: 94013.09      FT BELVOIR WATER CONSERVATION  
 FISCAL YEAR 1996      DISCRETE PORTION NAME: REPLACE STEAM TRAPS  
 ANALYSIS DATE: 03-18-96      ECONOMIC LIFE 7 YEARS      PREPARED BY: JWD

1. INVESTMENT

A. CONSTRUCTION COST	\$	36291.		
B. SIOH	\$	2178.		
C. DESIGN COST	\$	0.		
D. TOTAL COST (1A+1B+1C)	\$	38469.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$		0.	
F. PUBLIC UTILITY COMPANY REBATE	\$		0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)			\$	38469.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1994

FUEL	UNIT COST \$/ MWH(1)	SAVINGS MWH/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ .00	0.	\$ 0.	6.25	\$ 0.
B. DIST	\$ .00	0.	\$ 0.	6.75	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	7.27	\$ 0.
D. NAT G	\$ 18.19	5174.	\$ 94115.	6.81	\$ 640924.
E. COAL	\$ .00	0.	\$ 0.	6.66	\$ 0.
F. PPG	\$ .00	0.	\$ 0.	6.59	\$ 0.
M. DEMAND SAVINGS			\$ 0.	6.23	\$ 0.
N. TOTAL		5174.	\$ 94115.		\$ 640924.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		\$	7260.
(1) DISCOUNT FACTOR (TABLE A)	6.23		
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$	45230.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4) \$ 45230.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$  \$ 101375.

5. SIMPLE PAYBACK PERIOD (1G/4) .38 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 686153.

7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= 17.84  
 (IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 55.45 %

# spirax/sarco®

## Iron Float & Thermostatic Steam Traps

FT-15, FT-30, FT-75, FT-125

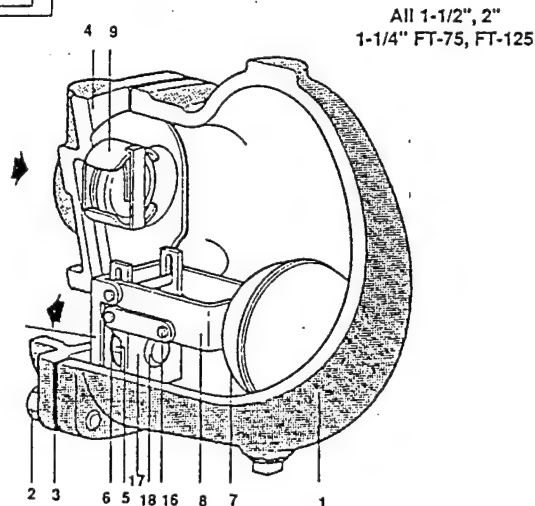
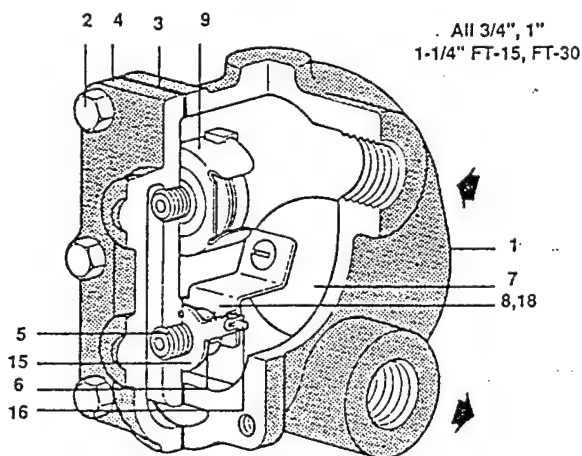
The trap contains a float valve mechanism which modulates to discharge condensate continuously at steam temperature, while non-condensable gases are released by a separate internal balanced pressure thermostatic air vent.

Model ⇐	FT-15	FT-30	FT-75	FT-125
PMO	15 psig	30 psig	75 psig	125 psig
Sizes	3/4", 1", 1-1/4", 1-1/2", 2"			
Connections	NPT			
Construction	Cast Iron Body & Cover Stainless Steel Internals			
Options	Liquid Drainer Configuration (tapped equalizing connection, no air vent) Steam Lock Release (SLR) (in addition to air vent) Gauge Glass			

### TYPICAL APPLICATIONS

All process equipment, particularly when controlled by modulating temperature control valves; unit heaters, air heating coils, heat exchangers and steam main drip stations

For Capacities,  
See TIS 2.317



### LIMITING OPERATING CONDITIONS

Max. Operating Pressure (PMO) FT-15: 15 psig (1.0 barg)  
FT-30: 30 psig (2.1 barg)  
FT-75: 75 psig (5.2 barg)  
FT-125: 125 psig (8.6 barg)

Max. Operating Temperature 45°F (25 °C) of superheat at all operating pressures

### PRESSURE SHELL DESIGN CONDITIONS

PMA 125 psig/0-450°F 9 barg/0-232 °C  
Max. allowable pressure

MA 450°F/0-125 psig 232 °C/0-9 barg  
Max. allowable temperature

### CONSTRUCTION MATERIALS

No.	Part	Material
1	Body	Cast Iron ASTM A126 CL B
2	Cover Screws	Carbon Steel Grade 5
3	Cover Gasket	Graphite
4	Cover	Cast Iron ASTM A126 CL B
5	Valve Seat	Stainless Steel Type 420F
6	Valve Seat Gasket	Stainless Steel (FTB-20) Type 302
7	Ball Float	Stainless Steel Type 304
8	Float Arm	Stainless Steel AISI 301/302/304
9	Air Vent Assembly	Stainless Steel
	Air Vent Head	Stainless Steel Type 440 GR B
	Air Vent Seat	Stainless Steel Type 303
15	Seat Bracket	Stainless Steel AISI 301/302/304
16	Pivot Pins	Stainless Steel Type 302 or 303
17	Head Bracket, Stop, Link	Stainless Steel Type 301
18	Valve Head	Stainless Steel Type 440 Gr.C

Local regulation may restrict the use of this product below the conditions quoted. Limiting conditions refer to standard connections only.  
In the interests of development and improvement of the product, we reserve the right to change the specification.

PAGE 9 3  
TIS 2.313 US 02.93

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Estimate:      WCO-13          Date:      12-Mar-96
Description:    REPLACE STEAM TRAPS
Project:        LIMITED EEAP (WTR) Bid Date:
Location:       FT BELVOIR, VA  Job #:      94013.09
Sq. footage:    MULTIPLE        City indx: Alexandria, VA
=====

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Line #	Description	Manhours	Matl	Labor	Equipment	Sub	Total
0100340100	CREATE COMPUTER DATA BASE					1.00 LS	
Unit values		0.00	0.00	0.00	0.00	1000.00	1000.00
Totals		0.00	\$0	\$0	\$0	\$1,000	\$1,000
0100340120	CONDUCT MAINTENANCE TRAINING					1.00 LS	
Unit values		0.00	0.00	0.00	0.00	2000.00	2000.00
Totals		0.00	\$0	\$0	\$0	\$2,000	\$2,000
0181602730	PROVIDE STEAM TRAP TESTING EQUIPMENT					1.00 LS	
Unit values		0.00	0.00	0.00	0.00	5000.00	5000.00
Totals		0.00	\$0	\$0	\$0	\$5,000	\$5,000
U01 GENL RQMTS		0	\$0	\$0	\$0	\$8,000	\$8,000

Line #	Description	Manhours	Matl	Labor	Equipment	Sub	Total
1500000010	STAINLESS STEEL I. D. TAGS					111.00 EA.	
Unit values		0.00	0.00	0.00	5.00	0.00	5.00
Totals		0.00	\$0	\$0	\$555	\$0	\$555
1562721010	REMOVE EXISTING HVAC STM TRAP F&T 15PSIG 3/4"					64.00 EA	
Unit values		2.00	0.00	30.25	0.00	0.00	30.25
Totals		128.00	\$0	\$1,936	\$0	\$0	\$1,936
1562721011	SUPPLY AND INSTALL NEW HVAC STM TRAP F&T 15PSIG 3/4" IPS					64.00 EA	
Unit values		1.00	79.00	15.13	0.00	0.00	94.13
Totals		64.00	\$5,056	\$968	\$0	\$0	\$6,024
1562721020	REMOVE EXISTING HVAC STEAM TRAP F&T 15PSIG 1" IPS					47.00 EA	
Unit values		2.00	0.00	30.25	0.00	0.00	30.25
Totals		94.00	\$0	\$1,422	\$0	\$0	\$1,422
1562721021	SUPPLY AND INSTALL NEW HVAC STEAM TRAP F&T 15PSIG 1"IPS					47.00 EA	
Unit values		1.00	120.00	15.13	0.00	0.00	135.13
Totals		47.00	\$5,640	\$711	\$0	\$0	\$6,351
U15 MECHANICAL		333	\$10,696	\$5,037	\$555	\$0	\$16,288

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=====
Line #      Description
-----
      Manhours  Matl    Labor  Equipment  Sub    Total
=====
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ESTIMATE TOTAL	333	\$10,696	\$5,037	\$555	\$8,000	\$24,288
SALES TAX	8.50%	\$909				
MATL MARKUP	11.00%	\$1,177				
LABOR MARKUP	33.00%		\$1,662			
EQUIPT MARKUP	5.00%			\$28		
SUB MARKUP	5.00%				\$400	
TOTAL BEFORE CONTINGENC		\$12,782	\$6,699	\$583	\$8,400	\$28,464
CONTINGENCY	15.00%					\$4,270
BOND	2.50%					\$712
PROFIT	10.00%					\$2,846
JOB TOTAL						\$36,291

```

=====
Estimate:      WCO-13          Date:      12-Mar-96
Description:   REPLACE STEAM TRAPS
Project:      LIMITED EEAP (WTR) Bid Date:
Location:     FT BELVOIR, VA   Job #:      94013.09
Sq. footage:  MULTIPLE        City indx: Alexandria, VA
=====

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## SUMMARY

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              Manhours   Matl      Labor   Equipment   Sub      Total
=====
U01 GENL RQMTS      0          $0          $0          $0      $8,000    $8,000
U15 MECHANICAL    333      $10,696    $5,037    $555          $0    $16,288
TOTAL              333      $10,696    $5,037    $555      $8,000    $24,288

SALES TAX          8.50%      $909
MATL MARKUP        11.00%      $1,177
LABOR MARKUP       33.00%      $1,662
EQUIPT MARKUP      5.00%      $28
SUB MARKUP         5.00%      $400

TOTAL BEFORE CONTINGENC $12,782    $6,699    $583      $8,400    $28,464
CONTINGENCY        15.00%      $4,270
BOND               2.50%      $712
PROFIT            10.00%      $2,846
JOB TOTAL                                $36,291

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## 9 FEMP PROJECT 6

FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.

FY95 EEAP

FY95 EEAP WATER SAVINGS OPPORTUNITY SURVEY, FT. BELVOIR, VA

CALCULATION WORK SHEET

DATE: 31 AUGUST 1995

FACILITY NO: Steam Systems served by Central Heating Plants in Buildings 332 & 1422

WCO-13 Steam Trap Replacement

### BASELINE

<u>Quantity</u>	<u>Trap Size</u>	<u>PPH Steam Loss/Trap</u>	<u>Annual Steam Loss</u>	<u>Annual Water Loss</u>
47	1 inch F&T	92	37,878,240 pounds	17,190,594 liters
64	3/4 inch F&T	61	34,199,040 pounds	15,520,833 liters
Annual Steam Consumption			72,077,280 pounds/yr 196 Btu/lb 14,127,146,880 Btu/yr	32,711,431 liters/yr

Energy Loss at a Boiler Efficiency of 80% = 17,658,933,600 Btu/yr  
or  
5,174 mWh

5,174 mWh                      32,711,431 liters/yr  
\$18.19 per mWh      \$0.6700 per 3,785 liters  
\$94,115 per year                      \$5,790 per year

### Proposed Retrofit

Replace all seam traps in steam systems served by Central Heating Plants 332 and 1422.

### Savings Summary

Annual Energy Savings of ..... 5,174 mWh  
Annual Energy Cost Savings of ..... \$94,115  
Annual Water Savings of ..... 32,711,430  
Annual Water Cost Savings of ..... \$5,790  
Annual Chemical Savings of ..... \$1,470  
  
Total Savings ..... \$101,376

## 10 FEMP PROJECT 7

FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.

### FEMP PROJECT 7: IMPLEMENTATION OF WCO-14: WATER DISTRIBUTION SYSTEM LEAK DETECTION AND REPAIR

The project consists of repairing leaks which were detected and documented during the leak detection survey of the Post water distribution system. The discounted savings are \$1,273,225 with an SIR of 15.69. The annual savings are \$85,566. The estimated construction cost to repair these leaks is estimated to be \$81,167.

In November 1995 Fort Belvoir exposed portions of the water distribution pipe at two locations identified to have leaks as reported in the Leak Detection Survey Report. One location is on a 6" main near Building 165. Refer to page 20 of the survey report. The leak identified was not found to exist at the location shown. The Post exposed the main at the location shown on page 20 and also excavated across the service road and found no indication of a leak. Excavation was halted to avoid potential damage to a root system of a tree. On March 5, 1996, Systems Corp and Health consultants made a return trip to the post in an attempt to resolve the matter. The survey team met with DPW and Dyne Corp at the site of the leak. The survey team was expecting to expose the pipe while at the site. However, the post had not scheduled a backhoe for the work. The leak survey team, using sonic detection, verified that the leak does exist. One explanation of the failure to expose the leak is that the measurements may be inaccurate due to the fact that the line runs under Building 165 and it may actually change direction underneath the building. As a result of the failure to expose the leak, the Post has elected to discontinue excavation for additional leaks identified in the survey report.

Below is a detailed index of the information included in this section:

Project LCCID Report .....	10-2
Catalog Cut Sheet .....	10-3
Project Cost Estimate.....	10-5
Project Calculation Sheets .....	10-9

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: BVRFEMP7

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID FY95 (92)

INSTALLATION & LOCATION: FT BELVOIR REGION NOS. 3 CENSUS: 3

PROJECT NO. & TITLE: 94013.09 FT BELVOIR WATER CONSERVATION

FISCAL YEAR 1996 DISCRETE PORTION NAME: WCO 14 REPAIR WATER MAIN LEAKS

ANALYSIS DATE: 03-15-96 ECONOMIC LIFE 20 YEARS PREPARED BY: JWD

1. INVESTMENT

A. CONSTRUCTION COST	\$	76572.	
B. SIOH	\$	4595.	
C. DESIGN COST	\$	0.	
D. TOTAL COST (1A+1B+1C)	\$	81167.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.	
F. PUBLIC UTILITY COMPANY REBATE	\$	0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		81167.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1994

FUEL	UNIT COST \$/ MWH (1)	SAVINGS MWH/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT	\$ 47.30	0.	\$ 0.	15.08	\$ 0.
B. DIST	\$ .00	0.	\$ 0.	18.57	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	21.02	\$ 0.
D. NAT G	\$ 18.19	0.	\$ 0.	18.58	\$ 0.
E. COAL	\$ .00	0.	\$ 0.	16.83	\$ 0.
F. PPG	\$ .00	0.	\$ 0.	17.38	\$ 0.
M. DEMAND SAVINGS			\$ 0.	14.88	\$ 0.
N. TOTAL		0.	\$ 0.		\$ 0.

3. NON ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)

(1) DISCOUNT FACTOR (TABLE A)	14.88	\$ 85566.
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 1273225.

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS (+) COST (-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS (+) / COST (-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2+3Bd4) \$ 1273225.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$  \$ 85566.

5. SIMPLE PAYBACK PERIOD (1G/4) .95 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 1273225.

7. SAVINGS TO INVESTMENT RATIO (SIR) = (6 / 1G) = 15.69  
(IF < 1 PROJECT DOES NOT QUALIFY)

\*\*\*\* Project does not qualify for ECIP funding; 4,5,6 for information only.

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): N/A



## AQUA-SCOPE®

### An Advanced Leak Detector For Fluids

For over 30 years Heath has been providing services and products for the detection of fluid leaks. Using this experience and the latest improvements in sonic and electronic components, Heath developed the AQUA-SCOPE fluid leak detector.

Operators find that the AQUA-SCOPE detector allows complete freedom of movement and superior concentration on the audio or visual signals, thereby improving on the detection and pinpointing of leaks from the surface.



## FEATURES

- Lightweight
- Rugged - metal protective housing
- Batteries - 2-9v Energizer No. 522 or equivalent
- Seismology grade pickup
- Comfortable to wear for long-term use
- Simple to use - only two control settings
- On/off switch for listening to leak sounds only
- Fixed filter
- Special sensor suspension shielding for optimum signal pickup

## OPERATING INFORMATION

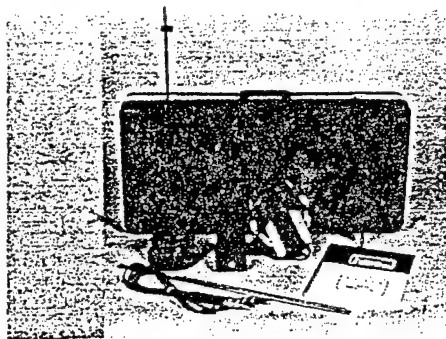
The AQUA-SCOPE detector is an instrument which amplifies the different frequencies (sound waves) generated by a leak.

The operator uses the ground microphone or the direct contact microphone to pick up the sound frequencies. Electro-sonic circuitry amplifies the sound of the leak for the headset and the receiver. The operator interprets the differences in signal strength to localize the leak for fast pinpointing.

- See back for Specifications and Ordering Instructions.

# AQUA-SCOPE®





AQUA-SCOPE® unit shown with optional meter module and battery charger

## SPECIFICATIONS

<b>Receiver Module:</b>	true-fidelity electronic module, provided with loops to be belt worn — 1.38 lbs. (.63 kg)	<b>Direct Contact Microphone Extensions:</b>	By adding 2 extensions supplied with kit, microphone extends to 4 ft. (121.9 cm). Additional extensions may be added to direct contact microphone - 2 ft. each (61 cm); 1 lb. (.45 kg).
<b>Power:</b>	2 - Energizer No. 522 or equivalent	<b>Magnetic tip: (accessory)</b>	Convenient accessory, added to direct contact microphone, adheres to all metal objects and allows arms to be free — 9 oz. (.25 kg).
<b>Operating Life:</b>	20 hours of continuous use	<b>Weight of Complete Unit Part No. 3768:</b>	17 lbs. (7.73 kg)
<b>Meter Module: (accessory)</b>	analog meter indicates intensity of leak, rechargeable, provided with loops to be belt worn — 1.44 lbs. (.65 kg)	<b>Carrying Case, H-W-L:</b>	plastic, rugged case — 14.5 x 6 x 30 in. (36.8 x 15.2 x 76.2 cm).
<b>Power:</b>	1 Ni-Cad, 9v rechargeable battery	<b>Shipping Carton, H-W-L:</b>	16 x 8 x 32 in. (40.6 x 20.3 x 81.3 cm).
<b>Battery Charger:</b>	available in 110v or 220v - .5 lbs. (.23 kg)	<b>Total Shipping Weight:</b>	20 lbs. (9.90 kg)
<b>Headset:</b>	600 ohms only — 1 lb. (.45 kg)	<b>Warranty:</b>	1 year workmanship & labor; 1 year parts
<b>Ground Microphone:</b>	supplied with lightweight, detachable handle — 29.5 in. (74.9 cm) long; 2.63 lbs. (1.2 kg)		
<b>Direct Contact Microphone:</b>	lightweight — 10.5 in. (26.7 cm) long; .75 lbs. (.34 kg)		

## HOW TO ORDER

HEATH NO.	DESCRIPTION
2903768	Heath AQUA-SCOPE complete unit includes: receiver module, ground microphone with handle, 2 microphone cables, direct contact microphone with 2 extensions, sound-protection headset, carrying case, and instruction manual.
<b>EXTRA ACCESSORIES</b>	
2923754	Meter Module with 110 VAC Battery Charger
2923698	Meter Module with 220 VAC Battery Charger
2923776	Magnetic Tip — use with Test Rod
2913774	Extension for Direct Contact Microphone
1900464	Plunger Bar with insulated handle
2901326	Resonant Plate, when used with plunger bar, increases the amplification of signal on soft soil.
7104585	GOOD VIBRATIONS slide/tape program — training presentation demonstrating sonic water leak detection equipment and survey. (Also available on VHS video tape, No. 7106653.)

### HEATH LOCATIONS

501 D. Harbor Boulevard  
P.O. Box 1267  
W. Sacramento, CA 95691  
(916) 371-2520  
FAX (916) 553-3001

1655 South Memorial Drive  
P.O. Box 546  
New Castle, IN 47362  
(317) 521-2068  
FAX (317) 521-2099

306 E. Main Street  
P.O. Box 511  
Norton, MA 02766  
(508) 285-9891  
FAX (508) 285-3778

Box 325, R.D. 3  
Belle Vernon, PA 15012  
(412) 929-2300  
FAX (412) 929-4872

135 Space Park Drive  
P.O. Box 110075  
Nashville, TN 37222  
(615) 833-1579  
FAX (615) 333-2693

9030 Monroe Road  
Houston, TX 77061  
(713) 946-7664  
FAX (713) 946-3032



Corporate Headquarters  
Heath Consultants Incorporated  
9030 Monroe Road  
Houston, TX 77061  
(713) 947-9292  
FAX (713) 947-0422

**For Product Information  
Sales & Instrument Repair  
Call: 1-800-HEATH-US  
(432-8487)**

Form M008 1193 2M

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Estimate:      WCO -14          Date:      15-Mar-96
Description:    MAIN WATER LINE REPAIRS
Project:        LIMITED EEAP (WTR) Bid Date:
Location:       FT BELVOIR, VA   Job #:      94013.09
Sq. footage:    MULTI           City indx: Alexandria, VA
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Line #	Description	Manhours	Matl	Labor	Equipment	Sub	Total
0222500900	EXCAVATION AND BACKFILL OF WATER LINE REPAIR PITS					120.00 C.Y.	
Unit values		4.00	0.00	197.63	0.00	0.00	197.63
Totals		480.00	\$0	\$23,716	\$0	\$0	\$23,716
0264043820	12" FLANGED GATE VALVE					1.00 Ea.	
Unit values		9.33	1883.38	178.72	30.49	0.00	2092.58
Totals		9.33	\$1,883	\$179	\$30	\$0	\$2,092
0266664850	16" MAIN 2" SERVICE TAP					1.00 Ea.	
Unit values		11.92	0.00	228.69	38.54	0.00	267.23
Totals		11.92	\$0	\$229	\$39	\$0	\$268
0266908020	6"x6" SLEEVE W/ RUBBER GASKET					3.00 Ea.	
Unit values		1.12	579.50	25.41	3.63	0.00	608.54
Totals		3.36	\$1,739	\$76	\$11	\$0	\$1,826
0266908060	8"x8" SLEEVE W/ RUBBER GASKET					2.00 Ea.	
Unit values		1.33	631.66	25.41	4.32	0.00	661.38
Totals		2.67	\$1,263	\$51	\$9	\$0	\$1,323
0266909040	8" GATE VALVE					4.00 Ea.	
Unit values		1.75	857.66	33.46	5.67	0.00	896.79
Totals		7.00	\$3,431	\$134	\$23	\$0	\$3,588
0266909060	10" GATE VALVE					1.00 Ea.	
Unit values		1.75	1390.80	33.46	5.67	0.00	1429.93
Totals		1.75	\$1,391	\$33	\$6	\$0	\$1,430
U02 SITEWORK		517	\$9,707	\$24,418	\$118	\$0	\$34,243

=====						
Line #	Description					
	Manhours	Matl	Labor	Equipment	Sub	Total
=====						
1517200420	6" FLANGED TEE					
Unit values	4.00	219.00	88.40	0.00	5.00 Ea.	
Totals	20.00	\$1,095	\$442	\$0	0.00	307.40
					\$0	\$1,537
1517200430	8"x8"x6" FLANGED TEE					
Unit values	4.80	340.00	106.24	0.00	3.00 Ea.	
Totals	14.40	\$1,020	\$319	\$0	0.00	446.24
					\$0	\$1,339
1517200430	8" FLANGED TEE					
Unit values	4.80	340.00	106.24	0.00	1.00 Ea.	
Totals	4.80	\$340	\$106	\$0	0.00	446.24
					\$0	\$446
1517200440	10"x10"x6" FLANGED TEE					
Unit values	6.00	780.00	133.00	0.00	4.00 Ea.	
Totals	24.00	\$3,120	\$532	\$0	0.00	913.00
					\$0	\$3,652
1517200440	10" FLANGED TEE					
Unit values	6.00	780.00	133.00	0.00	1.00 Ea.	
Totals	6.00	\$780	\$133	\$0	0.00	913.00
					\$0	\$913
1517200450	12"x12"x6" FLANGED TEE					
Unit values	8.00	1225.00	177.61	0.00	3.00 Ea.	
Totals	24.00	\$3,675	\$533	\$0	0.00	1402.61
					\$0	\$4,208
1517200450	12"x12"x8" FLANGED TEE					
Unit values	8.00	1225.00	177.61	0.00	1.00 Ea.	
Totals	8.00	\$1,225	\$178	\$0	0.00	1402.61
					\$0	\$1,403
1541706520	4" SPRINKLER CHECK VALVE					
Unit values	5.33	89.00	120.03	0.00	1.00 Ea.	
Totals	5.33	\$89	\$120	\$0	0.00	209.03
					\$0	\$209
U15 MECHANICAL	107	\$11,344	\$2,363	\$0	\$0	\$13,707

```
=====
Line #      Description
-----
            Manhours   Matl      Labor   Equipment   Sub      Total
=====

ESTIMATE TOTAL      624    $21,051    $26,781      $118          $0    $47,950

SALES TAX           4.50%          $947
MATL MARKUP        11.00%    $2,316
LABOR MARKUP       33.00%          $8,838
EQUIPT MARKUP       5.00%          $6
SUB MARKUP          0.00%          $0

TOTAL BEFORE CONTINGENC $24,314    $35,619    $124          $0    $60,057
CONTINGENCY         15.00%          $9,008
BOND                 2.50%          $1,501
PROFIT              10.00%          $6,006

JOB TOTAL                                $76,572
```



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=====
Estimate:      WCO -14          Date:      15-Mar-96
Description:    MAIN WATER LINE REPAIRS
Project:        LIMITED EEAP (WTR) Bid Date:
Location:       FT BELVOIR, VA   Job #:      94013.09
Sq. footage:    MULTI           City indx: Alexandria, VA
=====

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## SUMMARY

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-----
Manhours  Matl  Labor  Equipment  Sub  Total
=====
U02 SITEWORK      517    $9,707    $24,418      $118      $0    $34,243
U15 MECHANICAL    107    $11,344    $2,363        $0      $0    $13,707
TOTAL              624    $21,051    $26,781      $118      $0    $47,950

SALES TAX          4.50%      $947
MATL MARKUP        11.00%     $2,316
LABOR MARKUP       33.00%           $8,838
EQUIPT MARKUP      5.00%           $6
SUB MARKUP         0.00%           $0

TOTAL BEFORE CONTINGENC $24,314    $35,619      $124      $0    $60,057
CONTINGENCY        15.00%           $9,008
BOND                2.50%           $1,501
PROFIT              10.00%           $6,006

JOB TOTAL                                     $76,572

```

## 10 FEMP PROJECT 7

FY95S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. BELVOIR, VA.

FY95 EEAP

FY95 EEAP WATER SAVINGS OPPORTUNITY SURVEY, FT. BELVOIR, VA.

CALCULATION WORK SHEET

DATE: 12 MARCH 1996

FACILITY NO: WATER DISTRIBUTION SYSTEM

WCO-14: WATER DISTRIBUTION SYSTEM LEAK DETECTION SURVEY AND PIPE REPAIR

### BASELINE

<u>Quantity of Leaks</u>	<u>Pipe Size</u>	<u>Annual Water Loss</u>
31	Varies	483,424,678 liters/yr

Cost of Water Provided ..... \$0.177/kliter  
By Fairfax County Water Authority

Total Dollars Lost Due to Leaks..... \$85,566 per year

Proposed Pipe Leak Repair - Estimated Construction Cost \$81,167.

Repair All 31 Leaks Found and Documented in the Leak Detection Survey Report found in  
*Appendix E.*

### Savings Summary

Annual Water Savings of	483,424,678 liters/yr.
Annual Water Cost Savings of	\$85,566

---

# APPENDIX A

## Scope of Work

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DEPARTMENT OF THE ARMY  
BALTIMORE DISTRICT, U.S. ARMY CORPS OF ENGINEERS  
P.O. BOX 1715  
BALTIMORE, MD 21203-1715

REPLY TO  
ATTENTION OF

December 7, 1994

Engineering Division  
Military Branch

Mr. Keith Derrington  
Systems Engineering and Management Corporation  
2200 Sutherland Avenue  
Suite 306, Cherokee Place  
Knoxville, TN 37919

Dear Mr. Derrington:

References:

- a. Indefinite Delivery-Type Contract No. DACA01-94-D-0034.
- b. Site visit, June 30, 1994, at Fort Belvoir, Virginia regarding the Water Conservation Study.

Please submit a fee proposal by December 30, 1994, for Architect- Engineering services for referenced project in accordance with the enclosed revised statement of work dated December 6, 1994. The proposal should indicate the man-hour effort by disciplines, hourly rate, and overhead and profit rates as shown in the referenced contract. Also, indicate your concurrence with the proposed schedule for performing this work.

Please direct all inquiries regarding this project to my design manager, Mr. John M. Forgue, at (410) 962-4387.

Sincerely,

*David I. Roberts*  
David I. Roberts, Sr, P.E.  
Authorized Representative of  
the Contracting Officer

Enclosure

Copy Furnished:  
ANFB-PWE (Mr. Stumbaugh)  
CESAM-EN-DM (Mr. Battaglia)

SCOPE OF ARCHITECT-ENGINEER SERVICES  
FOR  
WATER SAVINGS OPPORTUNITY SURVEY (WSOS)  
FORT BELVOIR, VIRGINIA

Performed as part of the  
ENERGY ENGINEERING ANALYSIS PROGRAM (EEAP)

TABLE OF CONTENTS

1. BRIEF DESCRIPTION OF WORK.
2. GENERAL.
3. PROJECT MANAGEMENT.
4. SERVICES AND MATERIALS.
5. PROJECT DOCUMENTATION.
  - 5.1. ECIP Projects.
  - 5.2. Non-ECIP Projects.
  - 5.3. Nonfeasible WCOs.
6. DETAILED SCOPE OF WORK.
7. WORK TO BE ACCOMPLISHED.
  - 7.1. Review Previous Studies.
  - 7.2. Perform a Limited Site Survey.
  - 7.3. Reevaluate Selected Projects.
  - 7.4. Evaluate New WCOs.
  - 7.5. Provide Programming or Implementation Documentation.
  - 7.6. Submittals, Presentations, and Reviews.

ANNEXES

- A - WATER CONSERVATION OPPORTUNITIES.
- B - DETAILED SCOPE OF WORK.
- C - REQUIRED DD FORM 1391 DATA.
- D - EXECUTIVE SUMMARY GUIDELINE.

1. BRIEF DESCRIPTION OF WORK: The Architect-Engineer (A-E) shall:

1.1. Review for general information any previously completed Energy Engineering Analysis Program (EEAP) study and any other energy and/or water studies which were performed at Fort Belvoir.

1.2. Perform a limited site survey of selected buildings or areas to insure that any methods of water conservation which are practical and have not been evaluated in any previous study have been considered and the results documented.

1.3. Reevaluate selected projects and water conservation opportunities (WCOs) from the previous studies to determine their economic feasibility based on revised criteria, current site conditions and technical applicability.

1.4. Evaluate selected WCOs to determine their water savings potential and economic feasibility. \*

1.5. Provide complete programming or implementation documentation for all recommended WCOs.

1.6. Prepare a comprehensive report to document the work performed, the results and the recommendations.

2. GENERAL:

2.1. Other studies performed under EEAP may have been performed at Fort Belvoir. Criteria for both the studies and the resulting documentation has changed since the previous studies were completed. This study is intended to focus on water saving opportunities. This may require the reevaluation of selected projects from the previous studies which have not been implemented nor programmed for implementation and the consideration of specific WCOs in buildings and areas that may have been overlooked previously or recently identified. In particular, WCOs which may not have associated energy savings are to be considered.

2.2. The information and analysis outlined herein are considered to be minimum essentials for adequate performance of this study.

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\* Note that WCOs are evaluated on a monetary basis. That is, the total life-cycle cost, including cost savings from water, energy maintenance, etc. is to be considered when evaluating the viability of a WCO.

2.3. The A-E shall ensure that all methods of energy and water conservation which will reduce the water consumption of Fort Belvoir in compliance with Executive Order 12902 including those listed in ANNEXES A and B have been considered and documented. All methods of water conservation which are reasonable and practical shall be considered, including improvements of operational methods and procedures as well as the physical facilities. All water conservation opportunities which produce water, energy, or dollar savings shall be documented in this report. Any water conservation opportunity considered infeasible shall also be documented in the report with reasons for elimination. A list of general water conservation opportunities to be used when evaluating specific buildings or areas is included as ANNEX A. ANNEX B contains a list of WCOs specifically for Fort Belvoir. Both of these lists shall be considered and the evaluation of each WCO documented in the report. These lists are not intended to be restrictive but only to assure that basic and generally repetitive opportunities are addressed in the report. The A-E may be aware of other WCOs not included in ANNEX A or ANNEX B that will produce water, energy, manpower or dollar savings. These should be evaluated the same as the listed WCOs. Some of the water conservation opportunities in ANNEX A may not be applicable to the specific building or area at Fort Belvoir. A statement to that effect is all that is required.

2.4. The study shall include the buildings or areas listed in ANNEX B. The work in the areas may be reduced somewhat by building repetition.

2.5. The "Energy Conservation Investment Program (ECIP) Guidance", described in letter from DAIM-FDF-U, dated 10 January 1994, establishes criteria for ECIP projects and shall be used for performing the economic analyses of all WCOs and projects. Construction cost escalation for DD Form 1391 submission shall be calculated using the guidelines contained in AR 415-17 and the latest Tri-Service MCP Index. The Tri-Service MCP Index, when updated, is contained in the latest applicable edition of the Engineer Improvement Recommendation System (EIRS) bulletin.

2.6. Water conservation opportunities determined to be technically and economically feasible shall be developed into projects acceptable to Fort Belvoir. This may involve combining similar WCOs into larger packages which will qualify for ECIP or MCA funding, and determining, in coordination with Fort Belvoir, the appropriate packaging and implementation approach for all feasible WCOs.



3.5. Site Visits, Inspections, and Investigations. The A-E shall visit and inspect/investigate the site of the project as necessary and required during the preparation and accomplishment of the work.

3.6. Records.

3.6.1. The A-E shall provide a record of all significant conferences, meetings, discussions, verbal directions, telephone conversations, etc., with Government representative(s) relative to this contract in which the A-E and/or designated representative(s) thereof participated. These records shall be dated and shall identify the contract number, and modification number if applicable, participating personnel, subject discussed and conclusions reached. The A-E shall forward to the Contracting Officer within ten calendar days, a reproducible copy of the records.

3.6.2. The A-E shall provide a record of requests for and/or receipt of Government-furnished material, data, documents, information, etc., which if not furnished in a timely manner, would significantly impair the normal progression of the work under this contract. The records shall be dated and shall identify the contract number and modification number, if applicable. The A-E shall forward to the Contracting Officer within ten calendar days, a reproducible copy of the record of request or receipt of material.

3.7. Interviews. The A-E and the Government representative shall conduct entry and exit interviews with Fort Belvoir before starting work at the installation and after completion of the field work. The Government representative shall schedule the interviews at least one week in advance.

3.7.1. Entry. The entry interview shall describe the intended procedures for the survey and shall be conducted prior to commencing work at the facility. As a minimum, the interview shall cover the following points:

- a. Schedules.
- b. Names of analysts who will be conducting the site survey.
- c. Proposed working hours.
- d. Support requirements from Fort Belvoir.

3.7.2. Exit. The exit interview shall briefly describe the items surveyed and probable areas of water and energy conservation. The interview shall also solicit input and advice from Fort Belvoir.

4. SERVICES AND MATERIALS: All services, materials (except those specifically enumerated to be furnished by the Government), plant, labor, superintendence and travel necessary to perform the work and render the data required under this contract are included in the lump sum price of the contract.

5. PROJECT DOCUMENTATION: All water conservation opportunities which the A-E has considered shall be included in one of the following categories and presented in the report as such:

5.1. ECIP Projects. To qualify as an ECIP project, an WCO, or several WCOs which have been combined, must have a construction cost estimate greater than \$300,000, a Savings to Investment Ratio greater than one and a simple payback period of less than ten years. For ECAM projects, the \$300,000 limitation may not apply; in such cases, the A-E shall check with Fort Belvoir for guidance. The overall project and each discrete part of the project shall have an SIR greater than 1.25. All projects meeting the above criteria shall be arranged as specified in paragraph 2.6.1 and shall be provided with programming documentation. Programming documentation shall consist of a DD Form 1391, life cycle cost analysis (LCCA) summary sheet(s) (with necessary backup data to verify the numbers presented), and a Project Development Brochure (PDB). A life cycle cost analysis summary sheet shall be developed for each WCO and for the overall project when more than one WCO are combined. The water and/or energy savings for projects consisting of multiple WCOs must take into account the synergistic effects of the individual WCOs.

5.2. Non-ECIP Projects. Projects which do not meet ECIP criteria with regard to cost estimate or payback period, but which have an SIR greater than 1.25 shall be documented. Projects or WCOs in this category shall be arranged as specified in Paragraph 2.6.2 and shall be provided with the following documentation: the life cycle cost analysis (LCCA) summary sheet completely filled out, a description of the work to be accomplished, backup data for the LCCA, i.e., water and energy savings calculations and cost estimate(s), and the simple payback period. The water and energy savings for projects consisting of multiple WCOs must take into account the synergistic effects of the individual WCOs. In addition these projects shall have the necessary documentation prepared, as required by the Government representative, for one of the following categories:

5.2.1. Federal Energy Management Program (FEMP) Projects. A FEMP (or O&M Energy) project is one that results in needed maintenance or repair to an existing facility, or replaces a failed or failing existing facility, and also results in energy savings. The criteria are similar to the criteria for ECIP projects, i.e., SIR greater than 1.25, and simple payback period of less than ten years. Projects with a construction cost estimate up to \$1,000,000 shall be documented as outlined in Paragraph 5.2 above, projects over \$1,000,000 shall be documented on 1391s. In the FEMP program, a system may be defined as "failed or failing" if it is inefficient or technically obsolete. However, if this strategy is used to justify a proposed project, the equipment to be replaced must have been in use for at least three (3) years.

5.2.2. Low Cost/ No Cost Projects. These are projects which Fort Belvoir can perform using his resources. Documentation shall be as required by Fort Belvoir.

5.3. Nonfeasible WCOs. All WCOs which the A-E has considered but which are not feasible, shall be documented in the report with reasons and justifications showing why they were rejected.

6. DETAILED SCOPE OF WORK: The detailed Scope of Work is contained in ANNEX B.

7. WORK TO BE ACCOMPLISHED:

7.1. Review Previous Studies. The A-E shall review for general information the previous EEAP study along with any other water and/or energy studies performed at Fort Belvoir. This review should acquaint the A-E with the work that has been performed previously. Much of the information the A-E may need to develop the WCOs in this project will be contained in the previous studies. The survey data contained in the previous study should be very helpful to the results of this study.

7.2. Perform a Limited Site Survey. The A-E shall obtain all necessary data to evaluate the WCOs or projects by conducting a site survey. However, the A-E is encouraged to use any data that may have been documented in a previous study. The A-E shall document his site survey on forms developed for the survey, or standard forms, and submit these completed forms as part of the report. All test and/or measurement equipment shall be properly calibrated prior to its use.

7.3. Reevaluate Selected Projects. The A-E shall reevaluate the projects and ECOS\* listed in ANNEX B. These projects and ECOS are projects and ECOS that the previous study has identified but that have not been accomplished or only parts have been accomplished. If the project or ECO is acceptable as is, that is, there are no changes to the basic project or ECO, the water and energy savings shown in the previous project may be accepted as accurate but the construction cost estimates shall be updated based on the most current data available. With the above information the project shall then be analyzed based on current ECIP criteria. If the project or ECO is basically acceptable but some of the buildings in the original project have been deleted or new buildings can be added, the necessary changes shall be made to the water and energy savings, the water and energy costs and construction costs shall be updated and the revised project or ECO shall then be analyzed using current ECIP guidance. If the original project or ECO has had numerous changes made to it so that all of the numbers are suspected of being inaccurate, but the project or ECO is still considered feasible, the A-E shall develop the project from the beginning and analyze it with the current ECIP guidance. These projects shall be separately listed in the report.

7.4. Evaluate New WCOs. These WCOs shall be analyzed in detail to determine their feasibility. Savings to Investment Ratios (SIRs) shall be determined using current ECIP guidance. The A-E shall provide all data and calculations needed to support the conclusions. All assumptions shall be clearly stated. Calculations shall be prepared showing how all numbers in the WCO were figured. Calculations shall be an orderly step-by-step progression from the first assumption to the final number. Descriptions of the products, manufacturers catalog cuts, pertinent drawings and sketches shall also be included. A life cycle cost analysis summary sheet shall be prepared for each WCO and included as part of the supporting data. The following classes of WCOs are included:

7.4.1. General WCOs. The list of WCOs in ANNEX A shall be evaluated for the buildings or areas listed in ANNEX B. Those items on the list which are not practical, have been previously accomplished, are inappropriate or can be eliminated from detailed analysis based on preliminary analysis shall be listed in the report along with the reason for elimination from further analysis. All potential WCOs which are not eliminated by preliminary considerations shall be thoroughly documented and evaluated as to technical and economic feasibility.

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\* Previous studies focused on energy conservation opportunities (ECOs). The ECOS to be reevaluated are those which also provide a water saving opportunity.

7.4.2. Selected WCOs. These are the specific WCOs which are listed in ANNEX B.

7.4.3. Contractor-identified WCOs. These are those WCOs which the A-E is aware of or notes during the field survey that are not included in ANNEX A or ANNEX B but will produce water, energy, manpower or dollar savings. These should be evaluated the same as the listed WCOs.

7.5. Provide Programming or Implementation Documentation. During the Interim Review Conference, as outlined in paragraph 7.6.1, the A-E will be advised of Fort Belvoir's preferred packaging of recommended WCOs into projects for implementation. These projects will be documented as outlined in paragraphs 5.1, 5.2, and 5.3. Programming documentation will be included in the Prefinal Submittal per par 7.6.2. Programming documents shall be separate from the narrative report, and they shall be bound similarly to the final report in a manner which will facilitate repeated disassembly and reassembly.

7.6. Submittals, Presentations, and Reviews. The work accomplished shall be fully documented by a comprehensive report. The report shall have a table of contents and be indexed. Tabs and dividers shall clearly and distinctly divide sections, subsections, and appendices. All pages shall be numbered. The A-E shall give a formal presentation of all but the final submittal to installation, command, and other Government personnel. The A-E shall prepare slides or view graphs showing the results of the study to date for his presentation. During the presentation, the personnel in attendance shall be given ample opportunity to ask questions and discuss any changes deemed necessary to the study. A review conference will be conducted the same day, following the presentation. Each comment presented at the review conference will be discussed and resolved or action items assigned. The A-E shall provide the comments from all reviewers and written notification of the action taken on each comment to all reviewing agencies within three weeks after the review meeting. It is anticipated that each presentation and review conference will require approximately one working day. The presentation and review conferences will be at Fort Belvoir on the date(s) agreeable to Fort Belvoir, the A-E and the Government representative. The Contracting Officer may require a resubmittal of any document(s), if such document(s) are not approved because they are determined by the Contracting Officer to be inadequate for the intended purpose.

7.6.1. Initial Submittal. An interim report shall be submitted for review after completion of the field survey and an analysis has been performed on all of the WCOs. The report shall indicate the work which has been accomplished to date, illustrate

the methods and justifications of the approaches taken and contain a plan of the work remaining to complete the study. Calculations showing energy and dollar savings and SIRs of all the WCOs shall be included. The simple payback period of all WCOs shall be calculated and shown in the report. The A-E shall submit the Scope of Architect-Engineer Services and any modifications to the Scope of Architect-Engineer Services as an appendix to the report. A narrative summary describing the work and results to date shall be a part of this submittal. During the review period, the Government representative shall coordinate with Fort Belvoir and provide the A-E with direction for packaging or combining WCOs for programming purposes and also indicate the fiscal year for which the programming or implementation documentation shall be prepared. A sample implementation document (DD FORM 1391, sketches and manufacturers data, life cycle cost analysis summary sheet and supporting data) for one project shall be submitted with this submittal for review and approval. The survey forms completed during this audit shall be submitted with this report. The survey forms only may be submitted in final form with this submittal. They should be clearly marked at the time of submission that they are to be retained. They shall be bound in a standard three-ring binder which will allow repeated disassembly and reassembly of the material contained within.

7.6.2. Prefinal Submittal. The A-E shall prepare and submit the prefinal report when all work under this contract is complete. The A-E shall submit the Scope of Architect-Engineer Services and any modifications to the Scope of Architect-Engineer Services as an appendix to the submittal. The report shall contain a narrative summary of conclusions and recommendations, together with all raw and supporting data, methods used, and sources of information. The report shall integrate all aspects of the study. The report shall include an order of priority by SIR in which the recommended WCOs should be accomplished. The synergistic effects of all of the WCOs on one another shall have been determined and the results of the original calculations adjusted accordingly. Completed programming and implementation documents for all recommended projects shall be included. The programming and implementation documents shall be ready for review and signature by the installation commander. The prefinal report, separately bound Executive Summary and all appendices shall be bound in standard three-ring binders which will allow repeated disassembly and reassembly. The prefinal submittal shall be arranged to include (a) a separately bound Executive Summary to give a brief overview of what was accomplished and the results of this study using graphs, tables and charts as much as possible (See Annex D for minimum requirements), (b) the narrative report containing a copy of the Executive Summary at the beginning of the volume and describing in detail what was

accomplished and the results of this study, (c) appendices to include the detailed calculations and all backup material and (d) the programming and implementation documentation. A list of all projects and WCOs developed during this study shall be included in the Executive Summary and shall include the following data from the life cycle cost analysis summary sheet: the cost (construction plus SIOH), the annual energy savings (type and amount), the annual dollar savings, the SIR, the simple payback period and the analysis date. For all programmed projects also include the year in which it is programmed and the programmed year.

7.6.3. Final Submittal. Any revisions or corrections resulting from comments made during the review of the prefinal report or during the presentation and review conference shall be incorporated into the final report. These revisions or corrections may be in the form of replacement pages, which may be inserted in the prefinal report, or complete new volumes. Pen and ink changes or errata sheets will not be acceptable. If replacement pages are to be issued, it shall be clearly stated with the prefinal submittal that the submitted documents will be changed only to comply with the comments made during the prefinal conference and that the volumes issued at the time of the prefinal submittal should be retained. Failure to do so will require resubmission of complete volumes. If new volumes are submitted, they shall be in standard three-ring binders and shall contain all the information presented in the prefinal report with any necessary changes made. Detailed instructions of what to do with the replacement pages should be securely attached to the replacement pages.

ANNEX A

GENERAL WATER CONSERVATION OPPORTUNITIES

IRRIGATION

- \* Restrictions on time and duration of irrigation.
- \* Use of moisture sensors and/or timers to control irrigation.
- \* Use of reused water.
- \* Use of collected rainwater.
- \* Landscaping with low-maintenance plants (xeriscape).
- \* Irrigating with drip or mist emitters instead of spray irrigations.
- \* Use of sludge from treatment plants on irrigation areas to improve ground moisture retention.
- \* Installing separate non-potable water wells for irrigation.

HOUSING/ADMIN BUILDINGS

- \* Replace toilets with low-flow (1.6 gpf) models.
- \* Retrofit toilets with water-saving devices such as:
  - Fixed- or variable-volume displacement devices.
  - Dual flush devices.
  - Mechanical devices which alter cycle times.
- \* Replace showerheads with low-flow models to limit flow to 2.5 gpm or less.
- \* Retrofit showerheads with flow restrainer washers.
- \* Replace faucets with low-flow models, or install flow restrictors to limit flow to 2.5 gpm or less.
- \* Replace urinals with low-flow (1.0 gpf) models.
- \* Install pressure reducing valves.



- \* Replace water-consuming appliances with more water-efficient models (i.e. dishwashers & washing machines).
- \* Replace flowing water coolers with models using bottled water.

#### INDUSTRIAL

- \* Locate and quantify leaks in the water distribution system.
- \* Increase cycles of concentration of boilers and cooling towers by improving or altering chemical treatment.
- \* Automate blowdown/chemical feed on cooling towers.
- \* Upgrade boilers, cooling towers and associated equipment with more water-efficient models.
- \* Use of high pressure/hot water/low volume cleaning tools in maintenance areas.
- \* Remove water source from maintenance areas.

#### VEHICLE WASH

- \* Centralize vehicle wash facilities.
- \* Recycle wash water.

ANNEX B

DETAILED SCOPE OF WORK

BACKGROUND:

Current demand levels exceed 50 million gallons a month but, to date Fort Belvoir lacks an aggressive water conservation program. A cohesive and effective plan is needed to realize the tremendous water conservation potential in the 757 family housing units and 1,569 buildings currently on the installation. A plan would be provided along with a list of priority projects. ECIP documentation would be provided for appropriate projects.

PRE-NEGOTIATION CONFERENCE:

A pre-negotiation conference was held on 3 August 1994 at Fort Belvoir to review the general scope for the project and to develop this detailed scope of work. The following specific requirements were identified:

1. Fort Belvoir receives water from Fairfax County Water Authority and disposes of on-base sewage to Fairfax County Public Works. The study is to include all phases of water usage between these points; point(s) of receipt to point(s) of disposal.
2. Areas not included in the study are DCEETA, the Engineering Proving Ground, and Humphreys Engineer Center.
3. There are two (2) boiler plants on Fort Belvoir; Building Nos. 332 & 1422.
4. Fort Belvoir has been experiencing more than the normal number of water main breaks, possibly due to the severity of the past winter.
5. Fort Belvoir did not have any particular problem in mind when the study was requested, just the desire to have an overall view of the water system on base as a reference for future planning.
6. Fort Belvoir receives electric power from Virginia Electric and Power Company (VEPCO).
7. Master plans for Fort Belvoir and Fairfax County are to be referenced in determining future growth.

CENAB-EN-MS

8. Some storm drains on Fort Belvoir are known to be connected to sanitary sewers. Separating the two should be investigated.

9. An infiltration study for the sanitary sewer system is not included in this project. EEAP is not the proper medium for such studies.

SCHEDULE:

1. Interim Report: Submit within 120 calendar days after date of receipt of order.

2. Prefinal Report: Submit within 60 calendar days after receipt of interim report review comments.

3. Final Report: Submit within 30 calendar days after receipt of prefinal report review comments.

SUBMITTALS:

The reviewers for this project and the distribution of review copies for each submittal are as listed below. Submittal packages are to be sent by express/overnight mail. The transmittal letter to the Government representative will also be used to forward the other review copies by indicating "copies furnished according to the attached list" in the letter and attaching a list of the reviewers listed below. Highlight in yellow marker the recipient of each submittal package.

	<u>Reviewers</u>	<u>No. of Copies</u>		
		<u>1.</u>	<u>2.</u>	<u>3.</u>
1.	Baltimore District, Corps of Engineers ATTN: CENAB-EN-MS (Mr. Forgue) 10 S. Howard St., Room 10450 Baltimore, MD 21201	4	4	4
2.	US Army Garrison, Fort Belvoir ATTN: ANFB-PWE (Mr. Stumbaugh) 9430 Jackson Loop, Suite 107 Fort Belvoir, VA 22060-5130	6	6	6
3.	US Army Center for Public Works ATTN: CECPW-ES (Ms. Anderson) 9002 Black Road Building 1930 Fort Belvoir, VA 22060	1	1	1

CENAB-EN-MS

4. Military District of Washington Office of the Deputy Chief of Staff for Engineering and Housing ATTN: ANEN-IS (Mr. Gibson) Building 42, Fort Leslie J. McNair Washington, DC 20319-5050	1	1	1
5. Headquarters, US Army Corps of Engineers ATTN: CEMP-ET (Mr. Gentil) 20 Massachusetts Avenue, N.W. Washington, DC 20314-1000	0	0	1*
6. North Atlantic Division, Corps of Engineers ATTN: CENAD-EN-MM (Mr. Wong) 90 Church Street New York, NY 10007-2979	1	1	1
7. Mobile District, Corps of Engineers ATTN: CESAM-EN-DM (Mr. Battaglia) 109 St. Joseph Street Mobile, AL 36628-0001	1	1	1
8. Commander US Army Logistics Evaluation Agency ATTN: LOEA-PL (Mr. Keath) New Cumberland Army Depot New Cumberland, PA 17070-5007	0	0	1*

\* Executive Summary only.

SPECIAL CRITERIA AND INSTRUCTIONS:

A computer program titled "Life Cycle Costing in Design (LCCID)" is available from the BLAST Support Office in Urbana, Illinois for a nominal fee. This computer program can be used for performing the economic calculations for ECIP and non-ECIP ECOs. The A-E is encouraged to obtain and use this computer program. The BLAST Support Office can be contacted at 144 Mechanical Engineering Building, 1206 West Green Street, Urbana, IL 61801. Their telephone number is (217) 333-3977 or (800) 842-5278.

GOVERNMENT-FURNISHED DATA:

1. Final reports of previously completed studies performed under the Energy Engineering Analysis Program (EEAP).

2. Latest copies of other energy and/or water studies performed since the previous EEAP study.
3. ETL 1110-3-282, Energy Conservation.
4. ETL 1110-3-332, Economic Studies.
5. Architectural and Engineering Instructions.
6. Energy Conservation Investment Program (ECIP) Guidance, dated 10 January 1994.
7. Information on existing EMCS Studies, Designs, Construction Contracts, or Operating Systems. (Only if needed for this study).
8. TM 5-785, Engineering Weather Data.
9. TM 5-800-2, General Criteria Preparation of Cost Estimate.
10. TM 5-800-3, Project Development Brochure.
11. AR 415-15, Military Construction Army (MCA) Program Development.
12. AR 415-17, Cost Estimating for Military Programming.
13. AR 415-20, Construction, Project Development and Design Approval.
14. AR 415-28, Department of the Army Facility Classes and Construction Categories.
15. AR 11-27, Army Energy Program.
16. The latest applicable Engineer Improvement Recommendation System (EIRS) bulletin.
17. Example of a correctly completed implementation document.
18. Presidential Executive Order 12902, March 8, 1994, Energy Efficiency and Water Conservation at Federal Facilities.
19. Department of the Army Executive Order 12512, 31 March 1994, Installation Commander's Annual Real Property Utilization Survey, Fort Belvoir.

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20. Public Works Technical Bulletin 420-46-2, 30 September 1994, Procedure to Detect Water Distribution System Leaks.

21. AWWA Manual M36, Water Audits and Leak Detection.

22. Agenda, Water Conservation Study, Fort Belvoir, EEAP, 3 August 1994.

23. Fort Belvoir master plan and existing condition maps.

24. Water and waste water bills and readings.

25. Flow test data.

POINTS OF CONTACT:

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ANNEX C

REQUIRED DD FORM 1391 DATA

To facilitate ECIP project approval, the following supplemental data shall be provided:

- a. In title block clearly identify projects as "ECIP."
- b. Complete description of each item of work to be accomplished including quantity, square footage, etc.
- c. A comprehensive list of buildings, zones, or areas including building numbers, square foot floor area, designated temporary or permanent, and usage (administration, patient treatment, etc.).
- d. List references, and assumptions, and provide calculations to support dollar and energy savings, and indicate any added costs.
  - (1) If a specific building, zone, or area is used for sample calculations, identify building, zone or area, category, orientation, square footage, floor area, window and wall area for each exposure.
  - (2) Identify weather data source.
  - (3) Identify infiltration assumptions before and after improvements.
  - (4) Include source of expertise and demonstrate savings claimed. Identify any special or critical environmental conditions such as pressure relationships, exhaust or outside air quantities, temperatures, humidity, etc.
- e. Claims for boiler efficiency improvements must identify data to support present properly adjusted boiler operation and future expected efficiency. If full replacement of boilers is indicated, explain rejection of alternatives such as replace burners, nonfunctioning controls, etc. Assessment of the complete existing installation is required to make accurate determinations of required retrofit actions.
- f. Lighting retrofit projects must identify number and type of fixtures, and wattage of each fixture being deleted and installed. New lighting shall be only of the level to meet current criteria. Lamp changes in existing fixtures is not considered an ECIP type project.

g. An ECIP life cycle cost analysis summary sheet as shown in the ECIP Guidance shall be provided for the complete project and for each discrete part included in the project. The SIR is applicable to all segments of the project. Supporting documentation consisting of basic engineering and economic calculations showing how savings were determined shall be included.

h. The DD Form 1391 face sheet shall include, for the complete project, the annual dollar and MBTU savings, SIR, simple amortization period and a statement attesting that all buildings and retrofit actions will be in active use throughout the amortization period.

i. The calendar year in which the cost was calculated shall be clearly shown on the DD Form 1391.

j. For each temporary building included in a project, separate documentation is required showing (1) a minimum 10-year continuing need, based on the installation's annual real property utilization survey, for active building retention after retrofit, (2) the specific retrofit action applicable and (3) an economic analysis supporting the specific retrofit.

k. Nonappropriated funded facilities will not be included in an ECIP project without an accompanying statement certifying that utility costs are not reimbursable.

l. Any requirements required by ECIP guidance dated 4 November 1992 and any revisions thereto. Note that unescalated costs/savings are to be used in the economic analyses.

m. The five digit category number for all ECIP projects except for Family Housing is 80000. The category code number for Family Housing projects is 71100.



ANNEX D

EXECUTIVE SUMMARY GUIDELINE

1. Introduction.
2. Building Data (types, number of similar buildings, sizes, etc.)
3. Present Water Consumption.
  - o Total Annual Water Used.
  - o Water Consumption of buildings as compared to the basewide consumption.
4. Historical Water Consumption.
5. Reevaluated Projects Results.
6. Water Conservation Analysis.
  - o WCOs Investigated.
  - o WCOs Recommended.
  - o WCOs Rejected. (Provide economics or reasons)-
  - o ECIP Projects Developed. (Provide list)\*
  - o Non-ECIP Projects Developed. (Provide list)\*
  - o Operational or Policy Change Recommendations.
    - \* Include the following data from the life cycle cost analysis summary sheet: the cost (construction plus SIOH), the annual energy savings (type and amount), the annual dollar savings, the SIR, the simple payback period and the analysis date. For all programmed projects also include the year in which it is programmed and the programmed year cost.
7. Water, Energy, and Cost Savings.
  - o Total Potential Water, Energy, and Cost Savings.
  - o Percentage of Water and Energy Conserved.

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- o Water and Energy Use and Cost Before and After the Water Conservation Opportunities are Implemented.

8. Water Plan.

- o Project Breakouts with Total Cost and SIR.
- o Schedule of Water Conservation Project Implementation.

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## APPENDIX B

### Interim Review Comments and Responses

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Project Review Comments	Interim	<input checked="" type="checkbox"/> Project:	WSOS	Reviewer: Miklusak CENABEN-DD	Page: 1 of 2
	Pre-Final	<input type="checkbox"/> Location:	Fort Belvoir, Va.	Name:	Date: 14 Sept 95
	Final	<input type="checkbox"/> Year:	FY1995	Organizer:	

Comment No.	Vol.	Sec	Page	COMMENTS <input type="checkbox"/> Struc. <input type="checkbox"/> Arch. <input type="checkbox"/> Civ. <input checked="" type="checkbox"/> Mech. <input type="checkbox"/> Elec. <input type="checkbox"/> San. <input type="checkbox"/> Env. <input type="checkbox"/> Fire <input type="checkbox"/> Other	Action Code	RESOLUTIONS (include location of documents)	Ref.
1	1	2.2	2-	Report should include past history of water consumption and rates complete with a graphic table, and discussion on past and present demand trends.	A	A bar graph on consumption rates is included. Refer to Figure 2.2.1, Page 2-38.	
2	1	2.2	2-	Was infiltration/inflow for sewers factored into the net volumetric difference? Also, water leakage could be entering sewers. Can these items be quantified?	A	The flow rates for sewage and the water consumption was based on Fairfax County water authority invoices from July 1, 1994 through April 1995. The SOW does not include investigating infiltration of the sanitary sewer system. Refer to Annex B, Page B-2, Para. 9 of the Scope of Work.	
3	1	2.2	2-	What is the projected accuracy of the baseline consumption figures?	A	Baseline consumption figures used are from DOE and FEMP standards.	
4	1	Table 2.5.1	2-	Were these buildings surveyed to verify that there is no water services?	A	Most buildings on the list were not surveyed based on the building description, as noted in the real property list. Buildings, such as general warehouse storage and general labs were surveyed, one per group in any given location. The buildings were found to have no water service.	
5	1	Table 2.5.2	2-	Is water service shut off in abandoned or unoccupied buildings? If these buildings are used periodically, should they be evaluate in the survey?	A	Abandoned and unoccupied buildings were not accessible. A determination could not be made as to the position of the valve. If the valve was located outside the building, its location was not apparent.	
6	4	App. C	All	Literature on the leak detection equipment, such as catalog cuts briefly outlining operation, usage, and accuracy would be informative.	A	Catalog cuts of the leak detection equipment will be included in the Final Report.	

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A - Accepted/Concur

D - Action Deferred

N - Non-concur

VE - VE Potential/VEP Attached

W - Withdrawn

Project Review Comments	Interim	<input checked="" type="checkbox"/> Project:	WSOS	Reviewer: Miklusak CENABEN-DD	Page: 2 of 2
	Pre-Final	<input type="checkbox"/> Location:	Fort Belvoir, Va.	Name:	Date: 14 Sept 95
	Final	<input type="checkbox"/> Year:	FY1995	Organizer:	

Comment No.	Vol.	Sec	Page	COMMENTS <input type="checkbox"/> Struc. <input type="checkbox"/> Arch. <input type="checkbox"/> Civ. <input checked="" type="checkbox"/> Mech. <input type="checkbox"/> Elec. <input type="checkbox"/> San. <input type="checkbox"/> Env. <input type="checkbox"/> Fire <input type="checkbox"/> Other	Action Code	RESOLUTIONS (include location of documents)	Ref.
7	4	App. C	All	User should have a map of the water systems highlighting all of the surveyed lines.	A	The user has been provided with a copy of Fort Belvoir's water distribution drawings, highlighting the water lines surveyed and a number assigned to the location of the leak and keyed to the Leak Detection Survey Report.	
8	4	App. C	All	Is sonic detection the best method for finding leaks?	A	<p>There are two types of leak detection equipment:</p> <ol style="list-style-type: none"> <li>1) Sonic leak detection</li> <li>2) computerized correlator detector.</li> </ol> <p>Yes, for this application, sonic detection is more accurate than using a computerized leak correlator. Sonic detection is less costly with regard to equipment and time. The three types of surveys performed with the sonic detector are as follows:</p> <ol style="list-style-type: none"> <li>1) Comprehensive Survey - designed to find all the leaks in a system. Average daily production is approximately two miles per day.</li> <li>2) Modified Survey - designed to find the large to medium size leaks in a system. Average daily production is four to five miles per day.</li> <li>3) Value &amp; Hydrant Survey - designed to find a major leak in the system, average daily production is six to seven miles.</li> </ol> <p>Computerized leak correlators are designed to pinpoint known leaks, not to search an area for unknown leaks.</p>	

B-2

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W - Withdrawn

Project Review Comments	Interim	<input checked="" type="checkbox"/> Project:	WSOS	Reviewer: Carandang CENAB-END	Page: 1 of 2
	Pre-Final	<input type="checkbox"/> Location:	Fort Belvoir, Va.	Name:	Date: 28 Sept 95
	Final	<input type="checkbox"/> Year:	FY1995	Organizer:	

Comment No.	Vol.	Sec	Page	COMMENTS  <input type="checkbox"/> Struc. <input type="checkbox"/> Arch. <input type="checkbox"/> Civ. <input checked="" type="checkbox"/> Mech. <input type="checkbox"/> Elec. <input type="checkbox"/> San. <input type="checkbox"/> Env. <input type="checkbox"/> Fire <input type="checkbox"/> Other	Action Code	RESOLUTIONS (include location of documents)	Ref.
1				It seems that there is a great potential for water savings with the golf irrigation. Briefly explain the decision not to investigate this issue. No explanation was provided in the analysis.	A	Refer to Section 2, Para 2.1.2.2 and Page 2-3. Systems Corp found no cost savings for WCO-6 based on calculations performed from information gathered during the field survey.	
2				Will the results of this study lead to separate "Energy Conservation Investment Program (ECIP) funded projects? If so, ensure that the provisions of the latest ECIP guidance be strictly followed and incorporated. The latest guidance includes the most recent discount and energy escalation factors, economic analysis method of calculating SIR and life cycle, and the cost/factors to be used for the study.	A	Systems Corp used ECIP Guidance dated January 10, 1994, LCCID FY95 Version 1.0, Level 92 for LCC.	
3				The discussion on Section 5 states that the buildings listed on the different summary tables meet the ECIP criteria; however, this is not the case. Several buildings listed have SIR rating less than 1.25 and pay back period of more than 10 years, which does not meet the criteria. Please coordinate.	A	Buildings having an SIR of 1.25 or less are combined with buildings having an SIR of 1.25 or greater for each project. Together the buildings included in each project yield an SIR of 1.25 or greater.	

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VE - VE Potential/VEP Attached

W - Withdrawn

Project Review Comments	Interim	<input checked="" type="checkbox"/>	Project:	WSOS	Reviewer:	Carandang CENAB-EN-D	Page:	2 of 2
	Pre-Final	<input type="checkbox"/>	Location:	Fort Belvoir, Va.	Name:		Date:	28 Sept 95
	Final	<input type="checkbox"/>	Year:	FY1995	Organizer:			

Comment No.	Vol.	Sec	Page	COMMENTS <input type="checkbox"/> Struc. <input type="checkbox"/> Arch. <input type="checkbox"/> Civ. <input checked="" type="checkbox"/> Mech. <input type="checkbox"/> Elec. <input type="checkbox"/> San. <input type="checkbox"/> Env. <input type="checkbox"/> Fire <input type="checkbox"/> Other	Action Code	RESOLUTIONS (include location of documents)	Ref.
4				The information regarding the failed steam trap repair/replacement deserves more discussion, particularly how you came up with the investment costs (construction cost, etc.) and the discounted savings. Also, verify that the discount factor column in the life cycle cost analysis summary is correct and conforms with the ECIP Guidance.	A	<p>The economic analysis was performed using LCCID FY-95, Version 1.0 Level 92, which contains the correct discount factor, and conforms to the ECIP Guidance dated January 10, 1994.</p> <p>The steam systems served by the Central Heating Plants located in Buildings 332 and 1422 were surveyed and the steam traps tested. Exactly 111 failed or failing traps were identified using a combination of thermal and acoustic diagnostic methods. All of the failed traps were float and thermostatic traps. All of the inverted bucket traps that were tested found to be in operable condition. When a steam trap fails, steam is allowed to escape into the condensate system where it is eventually vented to atmosphere at the condensate receiver tank.</p> <p>Steam losses were calculated using Napier's Equation:</p> $W = (Pa)/(70)$ <p>W is the amount of steam in pounds per second.</p> <p>P is the absolute pressure before passing through the orifice in pounds per square inch.</p> <p>a is the area of the orifice in square inches.</p> <p>The orifice size was determined from published manufacturers data for the respective steam trap.</p> <p>Napier's Law states, "the flow of steam from a higher to lower pressure is proportional to the higher absolute pressure".</p> <p>Cost Estimates were performed utilizing Means Cost Data and the Means for Lotus Software. The Means Data provides cost information for the materials and labor required to remove and install steam traps.</p>	

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Project Review Comments	Interim	<input checked="" type="checkbox"/>	Project:	WSOS	Reviewer:	Lohorn CENABEN-MD	Page:	1 of 1
	Pre-Final	<input type="checkbox"/>	Location:	Fort Belvoir, Va.	Name:		Date:	22 Sept 95
	Final	<input type="checkbox"/>	Year:	FY1995	Organizer:			

Comment No.	Vol.	Sec	Page	COMMENTS <input type="checkbox"/> Struc. <input type="checkbox"/> Arch. <input type="checkbox"/> Civ. <input checked="" type="checkbox"/> Mech. <input type="checkbox"/> Elec. <input type="checkbox"/> San. <input type="checkbox"/> Env. <input type="checkbox"/> Fire <input type="checkbox"/> Other	Action Code	RESOLUTIONS (include location of documents)	Ref.
				There are no plumbing comments on this submittal.		No response required.	



<b>Project Review Comments</b>	<b>Interim</b>	<input checked="" type="checkbox"/> <b>Project:</b>	<b>WSOS</b>	<b>Reviewer:</b>	Jane Anderson CECPW-ES	<b>Page:</b>	1 of 2
	<b>Pre-Final</b>	<input type="checkbox"/> <b>Location:</b>	Fort Belvoir, Va.	<b>Name:</b>		<b>Date:</b>	04 Oct 95
	<b>Final</b>	<input type="checkbox"/> <b>Year:</b>	FY1995	<b>Organizer:</b>			

Comment No.	Vol.	Sec	Page	COMMENTS <input type="checkbox"/> Struc. <input type="checkbox"/> Arch. <input type="checkbox"/> Civ. <input checked="" type="checkbox"/> Mech. <input type="checkbox"/> Elec. <input type="checkbox"/> San. <input type="checkbox"/> Env. <input type="checkbox"/> Fire <input type="checkbox"/> Other	Action Code	RESOLUTIONS (include location of documents)	Ref.
1	1	2	2-18	Paragraph 2.4.2: What changes to golf course irrigation were considered before rejecting this WCO (i.e. use of treated wastewater, irrigation scheduling, etc.)	A	Refer to Section 2, Paragraph 2.1.2.2, Page 2-3. Systems Corp found no cost savings for WCO-6 based on calculations performed from information gathered during our field survey.	
2	1	2	2-19	Paragraph 2.4.7: As above. What was considered before eliminating this WCO?	A	Eleven of the 13 cooling towers with capacities greater than 100 tons have been equipped with automatic blowdown/chemical feed. Refer to Section 2, Para. 2.1.2.7, Page 2-4 and Table 2.1.2.7, Page 2-5.	
3	1	2	2-19	Paragraph 2.4.8: As above, what was considered before eliminating this WCO.		The existing Central Heating Plants located in Buildings 332 and 1422 and the cooling towers listed in Table 2.1.2.7 have automatic blowdown systems and a comprehensive water treatment program in place. No opportunities for improvements to the existing water treatment regimen were identified after reviewing the water treatment with Ft. Belvoir personnel.	
4	1	4	4-1	Paragraph 4.1.3: Change "bein" to "begin".	D	Correction is not necessary. Paragraph 4.1.3 is not included in the Final Report.	
5	1	5	5-2	Paragraph 5.7: change "munerous" to "numerous".	D	Correction is not necessary. Paragraph 5.7 is not included in the Final Report.	
6	1	5	5-2	What are the estimated costs for leak repair? What effect does this have on the payback?	A	Repair Cost = \$81,167 Discounted Savings = \$1,273,225 SIR = 15.69	
7	1	6	6-1	Please use Celsius for a temperature scale, rather than Kelvin.	A	A temperature scale is not used in the Final Report.	
8	2	9	9-2	Why is a 13.3 LPF valve kit specified? EPACT requires 6 LPF for most water closets?	A	The design of the fixture will not allow for proper washing of the fixture causing unsanitary conditions with a decrease in flow less than 13.2 LPF (3.5 gpf).	

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Project Review Comments				Interim	Project:	WSOS	Reviewer: Jane Anderson CECPW-ES	Page: 2 of 2
				Pre-Final	Location:	Fort Belvoir, Va.	Name:	Date: 04 Oct 95
				Final	Year:	FY1995	Organizer:	
Comment No.	Vol.	Sec	Page	COMMENTS <input type="checkbox"/> Struc. <input type="checkbox"/> Arch. <input type="checkbox"/> Civ. <input checked="" type="checkbox"/> Mech. <input type="checkbox"/> Elec. <input type="checkbox"/> San. <input type="checkbox"/> Env. <input type="checkbox"/> Fire <input type="checkbox"/> Other	Action Code	RESOLUTIONS (include location of documents)	Ref.	
9	2	10	10-1	What volume of water is saved by using the early closing flapper?	A	Approximately 7.6 LPF (2 gpf). Refer to manufacturer product data in Section 8.0.		
10	2	11	11-1	Why is a 1.5 gpf kit specified? EPACT standard is 1.0 for urinals. Please be consistent with units. Earlier items were listed in metric, this one is in English.	A	The design of the fixture will not allow for proper washing of the fixture causing unsanitary conditions with a decrease in flow less than 5.7 LPF (1.5 gpf).		
11	2	12	12-1	What is WCO 13: Please provide some narrative.	A	<p>The steam systems are served by the Central Heating Plants located in Buildings 332 and 1422 were surveyed and the steam traps tested. Exactly 111 failed or failing traps were identified using a combination of thermal and acoustic diagnostic methods. All of the failed traps were float and thermostatic traps. All of the inverted bucket traps that were tested found to be in operable condition. When a steam trap fails, steam is allowed to escape into the condensate system where it is eventually vented to atmosphere at the condensate receiver tank.</p> <p>Steam losses were calculated using Napier's Equation:  <math>W = (Pa)/(70)</math>  W is the amount of steam in pounds per second.</p> <p>P is the absolute pressure before passing through the orifice in pounds per square inch.</p> <p>a is the area of the orifice in square inches.</p> <p>The orifice size was determined from published manufacturers data for the respective steam trap.</p> <p>Napier's Law states, "the flow of steam from a higher to lower pressure is proportional to the higher absolute pressure".</p>		
12	2	14	14-1	Page is missing.	W	No response required.		

ACTION CODES:

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Project Review Comments	Interim	■	Project:	WSOS	Reviewer:	Tony Battaglia CENAB-EN-MS	Page:	1 of 5
	Pre-Final	□	Location:	Fort Belvoir, Va.	Name:		Date:	12 Oct 95
	Final	□	Year:	FY1995	Organizer:			

Comment No.	Vol.	Sec.	Page	COMMENTS <input type="checkbox"/> Struc. <input type="checkbox"/> Arch. <input type="checkbox"/> Civ. <input checked="" type="checkbox"/> Mech. <input type="checkbox"/> Elec. <input type="checkbox"/> San. <input type="checkbox"/> Env. <input type="checkbox"/> Fire <input type="checkbox"/> Other	Action Code	RESOLUTIONS (include location of documents)	Ref.
1	1	2	2-1	In Paragraph 2.1 there appears to be a small discrepancy. It states that "...over 214..." buildings were surveyed. By count of the buildings listed, it looks like 16 family housing, and 234 non-family housing for a total of 250. That's "...over 214...", but still a bit of a disparity. Please check and correct as needed.	A	The necessary corrections have been made. Please refer to Section 1, Paragraph 1.1.	
2	1	2	2-1	Paragraph 2.2 discusses baseline water consumption and sewage flow. It should also indicate the source of Fort Belvoir's potable water and whether Fort Belvoir has its own waste treatment plant or uses a publicly owned treatment system. Calculations for the cost of water should be covered, see Comment #19.	A	The source of Fort Belvoir's water which is provided by the Fairfax County Water Authority will be provided in the report. The sanitary sewage discharges to Fairfax County Water Authority's waste treatment plant.	
3	1	2	2-1	Paragraph 2.1 states that typical non-surveyed buildings were matched with representative buildings that were surveyed. In Table 2.1.1, it is very clear which family housing buildings were surveyed and which were not. In Table 2.1.2, it is not clear which non-family housing building were not surveyed. To me, it looked as if they were all surveyed. Please clarify.	A	There are no non-surveyed, non-family housing buildings matched with the representative buildings which were surveyed.	
4	1	2	2-1	Paragraph 2.3's last sentence leads the reader to expect a list of energy conservation opportunities on the following page, but instead one finds Tables 2.1.1 and 2.1.2. This should either be revised for clarified.	A	The list of water and energy savings does not exist. The sentence referencing such a list has been deleted. Suggestions were made to the fort regarding low cost/no cost WCOs during the exit interview.	
5	1	Table 2.1.2	2-	a.) Some of the abbreviations used in the "DESIGNATION" column are arcane. There is enough space in the column to expand these so that they will be more understandable. Please review and improve where possible. This would apply to other tables where the same information is presented. b.) Correct heading of "SQ FT" column. c.) For the fifth column, please clarify the heading; and define or provide a list of abbreviations for the entries.	A	The abbreviations used are the same as listed in the Real Properties List. Building numbers only will be listed in the tables for the Final Report.	

<b>Project Review Comments</b>	Interim	<input checked="" type="checkbox"/>	Project:	WSOS	Reviewer:	Tony Battaglia	Page:	2 of 5
	Pre-Final	<input type="checkbox"/>	Location:	Fort Belvoir, Va.	Name:	CENAB-EN-MS	Date:	12 Oct 95
	Final	<input type="checkbox"/>	Year:	FY1995	Organizer:			

Comment No.	Vol.	Sec.	Page	COMMENTS <input type="checkbox"/> Struc. <input type="checkbox"/> Arch. <input type="checkbox"/> Civ. <input checked="" type="checkbox"/> Mech. <input type="checkbox"/> Elec. <input type="checkbox"/> San. <input type="checkbox"/> Env. <input type="checkbox"/> Fire <input type="checkbox"/> Other	Action Code	RESOLUTIONS (include location of documents)	Ref.
6	1	2.4	2-	Some of the unevaluated energy and water conservation opportunities need additional explanation: a.) WCO-6: Golf course Irrigation b.) WCO-7: Water Efficient Appliances c.) WCO-9: High-Pressure/Hot Water/Low Volume Cleaning Tools d.) WCO-11: Cooling Tower Blowdown/Chemical Feed Automation e.) WCO-12: Boiler and Cooling Tower Chemical Treatment Improvements	A	Additional explanation will be provided. A) WCO-6: Golf Course Irrigation. Refer to <i>Paragraph 2.1.2.2, Page 2-3</i> . WCO-6 has been evaluated. B) WCO-7: Water Efficient Appliances. Refer to <i>Paragraph 2.1.2.3, Page 2-3</i> . C) WCO-9: High Pressure/Hot Water/Low Volume Cleaning Tools. Refer to <i>Paragraph 2.1.2.5, Page 2-4</i> . D) WCO-11: Cooling Tower Blowdown/Chemical Feed Automation. Refer to <i>Para. 2.1.2.7, Page 2-4, and Table 2.1.2.7, Page 2-5</i> . E) WCO-12: Boiler and Cooling Tower Chemical Treatment Improvements. Refer to <i>Paragraph 2.1.2.8., Page 2-4</i>	
7	1	3	3-2	<i>Paragraph 3.1.5</i> mentions measurements of existing flow rates. Is this described in more detail elsewhere? If so, please reference the page numbers. If not, please provide	A	Flow rates were measured from faucets with a flow measuring device called Micro Weir. Refer to <i>Section 2, Para. 2.1, Item 5</i> .	
8	1	3	3-3	<i>Paragraph 3.2.2.1, Spring-Loaded Faucets:</i> The duration of flow per use should also be important in this calculation. Please discuss.	A	The calculation is based on a duration of flow of 30 seconds and will be so stated in this section.	
9	1	3	3-3	<i>Paragraph 3.2.2.4, Water Closet Retrofits:</i> Please state if this is for flush valves only or for complete fixtures.	A	This is for flush valves only and will be so stated in the Final Report.	

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A - Accepted/Concur

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Project Review Comments	Interim	<input checked="" type="checkbox"/>	Project:	WSOS	Reviewer:	Tony Battaglia	Page:	3 of 5
	Pre-Final	<input type="checkbox"/>	Location:	Fort Belvoir, Va.	Name:	CENAB-EN-MS	Date:	12 Oct 95
	Final	<input type="checkbox"/>	Year:	FY1995	Organizer:			

Comment No.	Vol.	Sec.	Page	COMMENTS <input type="checkbox"/> Struc. <input type="checkbox"/> Arch. <input type="checkbox"/> Civ. <input checked="" type="checkbox"/> Mech. <input type="checkbox"/> Elec. <input type="checkbox"/> San. <input type="checkbox"/> Env. <input type="checkbox"/> Fire <input type="checkbox"/> Other	Action Code	RESOLUTIONS (include location of documents)	Ref.
10	1	3	3-4	<p>Paragraph 3.2.2.7, Water Efficient Equipment Upgrades:</p> <p>a.) This needs more explanation. Central plants or individual plants? Maintenance experience for buildings? Assumptions for this calculation should be stated and carefully reviewed. See Comment #23.</p> <p>b.) Delete extra word "an".</p>	A	<p>The steam systems served by the Central Heating Plants located in Buildings 332 and 1422 were surveyed and the steam traps tested. According to Ft. Belvoir personnel they had no record of a steam trap survey being done on the subject systems in the past ten years.</p> <p>Exactly 111 failed or failing traps were identified using a combination of thermal and acoustic diagnostic methods. All of the failed traps were float and thermostatic traps. All of the inverted bucket traps that were tested were found to be in operable condition. When a steam trap fails, steam is allowed to escape into the condensate system where it is eventually vented to atmosphere at the condensate receiver tank.</p> <p>Steam losses were calculated using Napiers Equation:  <math>W = (Pa)/(70)</math>  W is the amount of steam in pounds per second.  P is the absolute pressure before passing through the orifice in pounds per square inch.  a is the area of the orifice in square inches.</p> <p>The orifice size was determined from published manufacturers data for the respective steam trap.</p> <p>Napiers Law states, "the flow of steam from a higher to lower pressure is proportional to the higher absolute pressure".</p> <p>The correction has been made.</p>	
11	1	Fig. 3.4.1.1	3-7	Change Last month on the right from "April" to "March".	A		

ACTION CODES:  
A - Accepted/Concur

D - Action Deferred

N - Non-concur

VE - VE Potential/VEP Attached

W - Withdrawn

Project Review Comments	Interim	<input checked="" type="checkbox"/>	Project:	WSOS	Reviewer:	Tony Battaglia CENAB-EN-MS	Page:	4 of 5
	Pre-Final	<input type="checkbox"/>	Location:	Fort Belvoir, Va.	Name:		Date:	12 Oct 95
	Final	<input type="checkbox"/>	Year:	FY1995	Organizer:			

Comment No.	Vol.	Sec.	Page	COMMENTS <input type="checkbox"/> Struct. <input type="checkbox"/> Arch. <input type="checkbox"/> Civ. <input checked="" type="checkbox"/> Mech. <input type="checkbox"/> Elec. <input type="checkbox"/> San. <input type="checkbox"/> Env. <input type="checkbox"/> Fire <input type="checkbox"/> Other	Action Code	RESOLUTIONS (include location of documents)	Ref.
12	1	5	5-1	Paragraphs 5.4 and 5.5: These both mention the proposed use of early-closing flappers in flush tank water closets. Early closing of flapper may reduce water usage, but it could also interfere with complete flushing. Some backup on the efficacy of its recommendation is needed. Please provide and reference manufacturer's literature and/or other backup	A	Cut sheets are incorporated in the Final Report. Refer to Section 8 of the Final Report.	
13	1	5	5-2	Paragraph 5.7, Water Efficient Equipment Upgrades: See Comment #10 and #23.	A	See Response to Comment #10.	
14	1	5	General	Some of the tables in Section 5 which pertain to family housing have columns headed "COSTS" and "SAVINGS". Suggest labeling these "UNIT COST" and "UNIT SAVINGS".	A	Tables in Section 5 will be omitted.	
15	1	6	6-1	WCO-1, Spring-Loaded Faucets: In the LCCA Summary Sheet, it appears that the entire faucet is being replaced in year 10. This should be included in the discussion.	A	In replacing the faucet now, replacing the existing faucet in 10 years will be avoided.	
16	1	6-14	General	Each WCO discussion states that calculation sheets and cost estimates are provided in Appendix A. This is a good way to organize the repetitive information; however, some additional explanation is needed in the discussion. Suggest adding to the discussion a sample calculation for one typical case, stating all assumptions, and the LCCA summary sheet for that case.	A	Systems Corp will comply. Refer to Section 2.2.2, Page 2-39 and 2-40.	
17	1	6-14	General	Following each WCO discussion is a Summary Table, which is identical to the table in Section 5. Suggest keeping one or the other, but not both.	A	The Final Report incorporates a list of buildings affected by each WCO. For example, ECIP Project 1, Section 3, Table 3.1, will include buildings for which WCO-1 is recommended. FEMP Project 1, Section 4, Table 4.1 will list buildings for which WCO-2 is recommended., etc.	

B-11  
ACTION CODES:  
A - Accepted/Concur

D - Action Deferred

N - Non-concur

VE - VE Potential/VEP Attached

W - Withdrawn

Project Review Comments	Interim	<input checked="" type="checkbox"/> Project:	WSOS	Reviewer: Tony Battaglia CENAB-EN-MS	Page: 5 of 5
	Pre-Final	<input type="checkbox"/> Location:	Fort Belvoir, Va.	Name:	Date: 12 Oct 95
	Final	<input type="checkbox"/> Year:	FY1995	Organizer:	

Comment No.	Vol.	Sec.	Page	COMMENTS <input type="checkbox"/> Struc. <input type="checkbox"/> Arch. <input type="checkbox"/> Civ. <input checked="" type="checkbox"/> Mech. <input type="checkbox"/> Elec. <input type="checkbox"/> San. <input type="checkbox"/> Env. <input type="checkbox"/> Fire <input type="checkbox"/> Other	Action Code	RESOLUTIONS (include location of documents)	Ref.
18	1	6-14	General	LCCA Summary Sheets: a.) Title: To be consistent, suggest the title include the designation and name of the WCO, as in, "WCO1 Installation of Spring-Loaded Faucets". b.) Discrete Portion Name: The Discrete Portion Name should be the number of the building for which the WCO is being analyzed. c.) Suggest the LCCA Summary Sheets be located in the appendix with the calculations and cost estimates.	A & N	a.) The titles are consistent with the titles in the Table of Contents. The titles in the summary tables describe work to be performed relative to each WCO. b.) Concur. c.) Refer to Sections 3.0 through 10.0. The LCCA Summary Sheets, calculations and cost estimates are together in each individual ECIP project or FEMP project.	
19	All		General	Apparently water savings are being treated as annual-recurring non-energy savings in the Life-Cycle Cost Analyses. This should be discussed up front and a calculation provided for the development of water cost.	N	Water costs are taken from invoice statements from the Fairfax County Water Authority. Cost is \$0.67/1000 gallons of water.	
20	1	12	12-1	Include the discussion and sample calculation for the steam trap replacement WCO.	A	Concur. a. Refer to Response to comment #10 b. $W = (P)(a)/(70)$ $P = 139.7$ PSIA The orifice diameter is 0.125 inches $W = (139.7)(3.14)(0.0625)(0.0625)$ $W = 0.0255$ Pounds per second	
21	1	12	12-2	The Economic Life for WCO 13 should be 15 years rather than 20 years. See ECIP Guidance.		The economic life of the steam traps has been reduced to 7 years.	
22	1	14	14-1	Please indicate what type(s) of sensors were considered for ECO 16; photo-cell, infrared, ultra-sonic?	A	Infrared.	
23	4	App. B	B-1	WCO-13, Steam Trap Replacement: The proposed retrofit, i.e. "replacing all traps" is too general a statement. Some backup is needed to show how many traps actually need replacement and at what frequency (traps/yr or man-hours and materials/yr) maintenance should be performed.	A	Concur. a. Refer to Response to comment # 10 b. Steam traps should be tested every six months. Approximately 40 man hours per year would be required to perform the survey and record keeping that is required for an adequate steam trap maintenance program.	

B-12

ACTION CODES:  
A - Accepted/Concur

D - Action Deferred

N - Non-concur

VE - VE Potential/VEP Attached

W - Withdrawn



Project Review Comments	Interim	<input checked="" type="checkbox"/>	Project:	WSOS	Reviewer:	R. Gibson	Page:	1 of 1
	Pre-Final	<input type="checkbox"/>	Location:	Fort Belvoir, Va.	Name:	DCSEH	Date:	03 Oct 95
	Final	<input type="checkbox"/>	Year:	FY1995	Organizer:			

Comment No.	Vol.	Sec	Page	COMMENTS <input type="checkbox"/> Struc. <input type="checkbox"/> Arch. <input type="checkbox"/> Civ. <input checked="" type="checkbox"/> Mech. <input type="checkbox"/> Elec. <input type="checkbox"/> San. <input type="checkbox"/> Env. <input type="checkbox"/> Fire <input type="checkbox"/> Other	Action Code	RESOLUTIONS (include location of documents)	Ref.
1	1			Assume conscious decision was made to omit AAFES facilities. What was rational?	A	According to the latest ECIP Guidance, non-appropriated funded facilities will not be included in an ECIP project without an accompanying statement certifying that utility costs are paid for by the army.	
2	1	5	5-3	What is the purpose of the column at the extreme right (QTY) of, for example, Table 5.1.1? Seems that column should have been the number of widgets required to retrofit that facility.	A	Table 5.1.1 will not be incorporated into the Final Report. The quantity of retrofits appear in the estimates for each project.	
3				This is MDWs fist Water Savings Opportunity Survey, and therefore cannot be compared to any previous studies with in the command.		No response required.	
4				Systems Corp seems to have done a good job on this one.		No response required.	



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Pre-Final Review Comments  
and  
Responses

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<b>Project Review Comments</b>	Interim	Project:	WSOS	Reviewer: Kiersarsky	Page: 1 of 1
	Pre-Final	Location:	Fort Belvoir, Va.	Name:	Date: 14 Sept 95
	Final	Year:	FY1995	Organizer:	

Comment No.	Vol.	Sec	Page	COMMENTS <small><input type="checkbox"/> Struc. <input type="checkbox"/> Arch. <input type="checkbox"/> Civ. <input checked="" type="checkbox"/> Mech. <input type="checkbox"/> Elec. <input type="checkbox"/> San. <input type="checkbox"/> Env. <input type="checkbox"/> Fire <input type="checkbox"/> Other</small>	Action Code	RESOLUTIONS (include location of documents)	Ref.
1		general		In the family housing area, a cheap way to save water would be to place a plastic container filled with water in the water tank of each toilet. For a family of four, this would result in a savings of three gallons per day based on three flushes per person using a quart container.	A	Your suggestion to place a plastic container in the tank type water closets is a cheap method of saving water. However, the containers are likely to be removed and discarded by the occupants of the building. An early closing flapper or 1.6 gallon flush tanks are a less obvious and more permanent fix, although the flappers will have to be replaced periodically by maintenance.	
2		general		Have water meter read outs been checked at various buildings to determine if any unusual amounts of water have been used and what corrections could be incorporated?	A	The survey revealed that there are very few, if any, individual meters for individual buildings. Ideally, each building should be metered for the reason stated in your comments. Meters would also be an aid in locating leaks in the water system within the building.	

ACTION CODES:  
A - Accepted/Concur

D - Action Deferred

N - Non-concur

VE - VE Potential/VEP Attached

W - Withdrawn

<b>Project Review Comments</b>	<b>Interim</b>	<input type="checkbox"/> Project:	<b>WSOS</b>	<b>Reviewer:</b> Kamphaus CENAB-EN	<b>Page:</b> 1 of 1
	<b>Pre-Final</b>	<input checked="" type="checkbox"/> Location:	<b>Fort Belvoir, Va.</b>	<b>Name:</b>	<b>Date:</b> 12 April 96
	<b>Final</b>	<input type="checkbox"/> Year:	<b>FY1995</b>	<b>Organizer:</b>	

Comment No.	Vol.	Sec	Page	COMMENTS <input type="checkbox"/> Struc. <input type="checkbox"/> Arch. <input type="checkbox"/> Civ. <input checked="" type="checkbox"/> Mech. <input type="checkbox"/> Elec. <input type="checkbox"/> San. <input type="checkbox"/> Env. <input type="checkbox"/> Fire <input type="checkbox"/> Other	Action Code	RESOLUTIONS (include location of documents)	Ref.
1		2	7	Table 2.1.3.1 lists facilities not surveyed due to no water services. Some of these buildings, from the names, seem as if they could have steam services. If so, could they be candidates for savings if they were found to have leaking steam systems in them? Please address the question.		Please refer to the scope of work in section A of this report. The steam distribution system is not a part of this scope. However, Systems Corp has performed a steam distribution survey, including an aerial leak detection survey of the underground piping at Fort Belvoir. This survey was performed under a separate contract.	
2		9	1	FEMP Project 6. Implementation of WCO-13: Water Efficient Upgrades and Steam Trap Replacement. The discussion includes using iron float and thermostatic steam traps. Were other types of traps considered? The use of the correct steam trap types for each individual application is very important and affects the efficiencies of the steam use. The proper steam trap selection should also be a factor in the analysis.		The traps selected match the traps which exist at the post and are leaking, or failed, and those which are old and deteriorating.	

ACTION CODES:  
A - Accepted/Concur

D - Action Deferred

N - Non-concur

VE - VE Potential/VEP Attached

W - Withdrawn

Project Review Comments	Interim	<input type="checkbox"/>	Project:	WSOS	Reviewer:	David L. Hale Acting Director Directorate of Public Works	Page: 1 of 1
	Pre-Final	<input checked="" type="checkbox"/>	Location:	Fort Belvoir, Va.	Name:		Date: 24 April 96
	Final	<input type="checkbox"/>	Year:	FY1995	Organizer:		

Comment No.	Vol.	Sec	Page	COMMENTS <input type="checkbox"/> Struc. <input type="checkbox"/> Arch. <input type="checkbox"/> Civ. <input checked="" type="checkbox"/> Mech. <input type="checkbox"/> Elec. <input type="checkbox"/> San. <input type="checkbox"/> Env. <input type="checkbox"/> Fire <input type="checkbox"/> Other	Action Code	RESOLUTIONS (include location of documents)	Ref.
1				Clarify if the cost estimate was calculated for 250 buildings or for the entire post.	A	Refer to Section 1, Para. 1.4.3, Page 1-5. The number of buildings considered for each project is stated in this paragraph.	
2				Please ensure that units used in the report are uniform throughout the entire report.	A	No response required.	
3				Section B-5 indicates that Michael Stumbaugh is the point of contact at Fort Belvoir for the WSOS. Please change the name to Wayne Stone/Tish Tyson.	A	Correction will be made.	

<b>Project Review Comments</b>	Interim	<input type="checkbox"/>	Project:	WSOS	Reviewer: Anthony Battaglia CESAM-EN-DM	Page: 1 of 2
	Pre-Final	<input checked="" type="checkbox"/>	Location:	Fort Belvoir, Va.	Name:	Date: 17 April 96
	Final	<input type="checkbox"/>	Year:	FY1995	Organizer:	

Comment No.	Vol.	Sec	Page	COMMENTS <input type="checkbox"/> Struct. <input type="checkbox"/> Arch. <input type="checkbox"/> Civ. <input checked="" type="checkbox"/> Mech. <input type="checkbox"/> Elec. <input type="checkbox"/> San. <input type="checkbox"/> Env. <input type="checkbox"/> Fire <input type="checkbox"/> Other	Action Code	RESOLUTIONS (include location of documents)	Ref.
1		general		This submittal is a big improvement over the interim. The packaging of the recommended WCOs is a very good feature.		No comment necessary.	
2		2	6	Par. 2.1.3: This paragraph mentions "energy conservation opportunities"; change to "water conservation opportunities."		Corrections have been made.	
3		2	37	Par. 2.2.1: See my previous comment on this section. The response was satisfactory, but the information requested is still not presented all in one location. One has to search for it throughout the report. Suggest adding a brief discussion on the source of the potable water and the method of treating waste water, and add the calculations for unit cost of water and sewage to this section.		A brief narration will be added to Section 1, Para. 1.1, describing the source of the post water supply, sewer discharge and cost/K liters for each. Reference will be made to Section 2, Para. 2.2.1, Page 2-37 for a more detailed discussion of baseline water and energy consumption and costs.	
4		2	40	Regarding the assumption of a 50 F delta-T: 115-55 does not = 50. Correct as needed.		Correction has been made.	
5		2	40	Regarding the statement, "...because every KL of water that enters the post via the water mains is assumed to leave the post via the sewer mains." For any WCO dealing with plumbing fixtures, it can be assumed that all of the water supplied will exit through the sewer system. However, the quoted statement is incorrect; see the discussion on pg 2-37. About half of the water supplied is used for irrigation or lost through leaks. Please correct.		The statement has been deleted.	
6		2	40	Correct typo on "Gas Rate."		Correction has been made.	
7		2	41	Par. 2.2.3.4: This paragraph mentions an SIR requirement of 1.25 percent. "Percent" is not an appropriate term to use with "SIR". Please correct.		Percent has been deleted.	
8		2.2 General		Add a discussion of maintenance and repair costs/savings to each WCO description. See Comment 11 below.		A discussion has been added.	
9		2	45	Par. 2.5: This is a very general statement; but it does not show HOW the various factors are incorporated. See Comment 11 below.		Please refer to the sample calculations in Section 2, page 2-40.	

B-17

ACTION CODES:  
A - Accepted/Concur

D - Action Deferred

N - Non-concur

VE - VE Potential/VEP Attached

W - Withdrawn

<b>Project Review Comments</b>	Interim	<input type="checkbox"/>	Project:	WSOS	Reviewer: Anthony Battaglia CESAM-EN-DM	Page: 2 of 2
	Pre-Final	<input checked="" type="checkbox"/>	Location:	Fort Belvoir, Va.	Name:	Date: 17 April 96
	Final	<input type="checkbox"/>	Year:	FY1995	Organizer:	

Comment No.	Vol.	Sec	Page	COMMENTS <input type="checkbox"/> Struc. <input type="checkbox"/> Arch. <input type="checkbox"/> Civ. <input checked="" type="checkbox"/> Mech. <input type="checkbox"/> Elec. <input type="checkbox"/> San. <input type="checkbox"/> Env. <input type="checkbox"/> Fire <input type="checkbox"/> Other	Action Code	RESOLUTIONS (include location of documents)	Ref.
10		2	46	Par. 2.5.1: See Comment 3 above.			
11		2	48	Par. 2.5.2: Suggest adding a brief description for each WCO that has maintenance and repair costs or savings in the appropriate part of Section 2.2. Also provide a copy of the cost estimate (as discussed in par. 2.5.2) in each affected WCO package.		A brief discussion has been added as requested. An actual cost estimate was not created. A lump sum cost per faucet was taken from the <i>Means Facilities Maintenance and Repair Costs Data</i> .	
12		3	7	The Annual Recurring Non-Energy Savings shown on the LCCA Summary Sheet for WCO-1 is approximately \$8,000 (20%) lower than the savings calculated by using the Water Dollar Saving from the spreadsheet less the \$19.52 per faucet mentioned on page 2-48. Why? Please clarify. See Comment 11.		Maintenance cost is \$19.72, not \$19.52. Typo has been corrected. The figure \$33,838 is incorrect and should read \$40,620. LCCID input error has been corrected and LCCID revised.	
13		3	7	The Non-Recurring Non-Energy Savings was questioned in the interim review. The written response was satisfactory, but there has been no follow-up in the pre-final. There is no mention of nor cost estimate for this replacement savings in year 10. Please provide; see Comment 11.		The cost to accomplish the project is considered to be the non-recurring non-energy savings. The cost is as shown at the top of the LCCID form which is the estimated construction cost plus SIOH and design. It was done this way since we considered doing the project in year one. This avoids the inevitability of doing the project, which would include SIOH and design, in year ten.	
14		7	3	The Annual Recurring Non-Energy Savings is lower than the water dollar savings from the spreadsheet by approximately \$6,800 (8%). Why? Are there M&R costs? Apparently there were no M&R costs for the other Aerator WCO (WCO-2). Please clarify. See Comment 11.		The figure in question was in error and has been corrected.	
15		8	1	Correct typo, \$97,746.		Correction has been made	
16		9	8	Add units of liters where appropriate.		Corrections have been made.	

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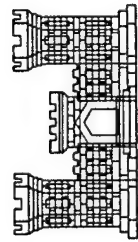
# APPENDIX C

## Interim Review Presentation

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# Water Savings Opportunity Survey (WSOS)

Fort Belvoir, Virginia



Baltimore District-  
US Army Corps  
of Engineers

**SYSTEMS***corp*

SYSTEMS ENGINEERING AND MANAGEMENT CORPORATION



# Work Accomplished to Date

- Field Survey Completed
- Preparation and Completion of Field Notes
- Baseline Water and Energy Conservation Calculations
- Evaluation of 16 Water and Energy Conservation Opportunities
- Completion of LCCAs
- Completion of Interim Report

# Recommended WCOs

WCO-1

WCO-4

WCO-2

WCO-13

WCO-2FH

WCO-14

WCO-3

WCO-3FH

# WCO-1: Spring Loaded Faucets

Cost: \$710,388

Discounted Savings : \$1,443,767

SIR: 2.03

## WCO-2: Faucet Aerators

Cost: \$3,301

Discounted Savings : \$204,765

SIR: 62.03

# WCO-2FH: Faucet Aerators

Cost: \$74,077

Discounted Savings : \$1,881,135

SIR: 25.39

# WCO-3: Water Closet Retrofits

## Flush Valve Replacements

Cost: \$257,382

Discounted Savings : \$536,573

SIR: 2.08

# WCO-3FH: Water Closet Retrofits Early Closing Flappers

Cost: \$100,171

Discounted Savings : \$1,264,744

SIR: 12.63

# WCO-3AFH: Water Closet Replacement

Cost: \$127,390

Discounted Savings : \$206,372

SIR: 1.62



## WCO-4: Urinal Flush Valve Retrofits

Cost: \$147,420

Discounted Savings : \$1,270,648

SIR: 8.62

## WCO-13: Water Efficient Equipment Upgrades Steam Trap Replacement

Cost: \$30,659

Discounted Savings : \$1,658,652

SIR: 54.1

# WCO-14: Leak Detection

Cost: \$7,044 - Survey

Cost: \$75,000 - Repair

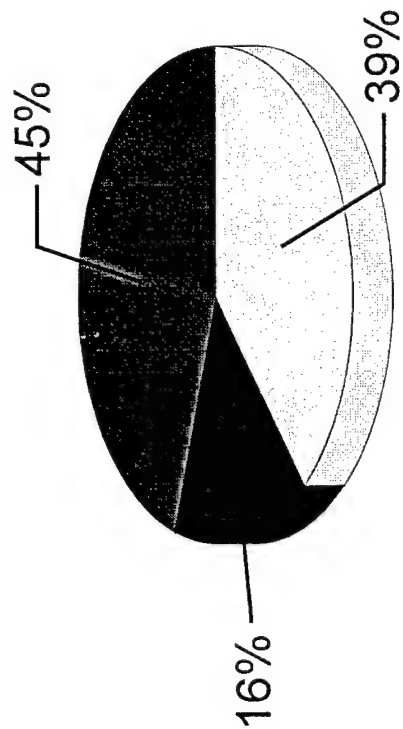
Total: \$82,044

Discounted Savings : \$1,283,595

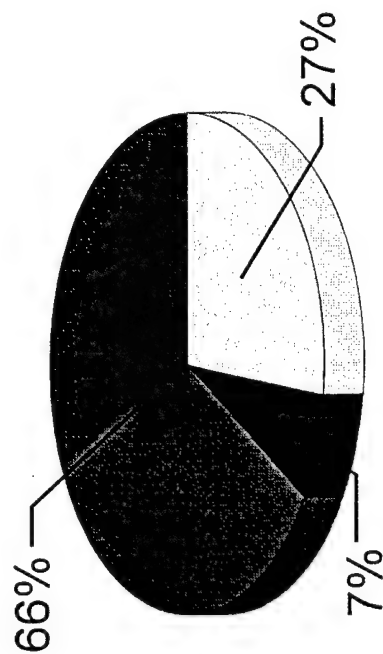
SIR: 15.65

# Fort Belvoir Consumption vs Cost

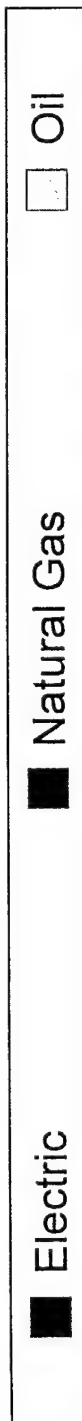
FY 95



Total 1,158,164MBTU's



Total \$10,010,494



# Cost and SIR by ECO

ECO	Cost	SIR
1	\$710,388	2.03
2	3,301	62.03
2FH	74,077	25.63
3	257,382	2.08
3FH	100,171	12.63
3AFH	127,390	1.62
4	147,420	8.62
13	30,659	54.1
14	82,044	15.65

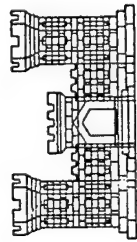
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## Pre-Final Review Presentation

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# Water Savings Opportunity Survey (WSOS)

Fort Belvoir, Virginia



Baltimore District-  
US Army Corps  
of Engineers

**SYSTEMS***corp*

SYSTEMS ENGINEERING AND MANAGEMENT CORPORATION

# Work Accomplished to Date

- Field Survey Completed
- Preparation and Completion of Field Notes
- Baseline Water and Energy Conservation Calculations
- Evaluation of 16 Water and Energy Conservation Opportunities
- Completion of LCCAs
- Completion of Interim Report
- Completion of Pre-Final Report



# Recommended Projects

ECIP-1

WCO-1

FEMP-1

WCO-2

FEMP-2

WCO-3

FEMP-3

WCO-4

FEMP-4

WCO-2FH

FEMP-5

WCO-3FH

FEMP-6

WCO-13

FEMP-7

WCO-14

ECIP-1

WCO-1: Spring Loaded Faucets

Cost: \$698,464

Discounted Savings : \$1,540,533

SIR: 2.21

FEMP-1

WCO-2: Faucet Aerators

Cost: \$3,289

Discounted Savings : \$165,230

SIR: 66.55

FEMP-2

WCO-3: Water Closet Retrofits

Flush Valve Replacements

Cost: \$155,072

Discounted Savings : \$291,530

SIR: 1.68

FEMP -3

WCO-4: Urinal Flush Valve Retrofits

Cost: \$9,146

Discounted Savings : \$35,405

SIR: 3.87

FEMP-4

WCO-2FH: Faucet Aerators

Cost: \$70,632

Discounted Savings : \$1,969,275

SIR: 27.88

FEMP-5

WCO-3FH: Water Closet Retrofits  
Early Closing Flappers

Cost: \$97,746

Discounted Savings : \$1,288,043

SIR: 13.18

FEMP-6

WCO-13: Water Efficient Equipment Upgrades  
Steam Trap Replacement

Cost: \$38,469

Discounted Savings : \$686,153

SIR: 17.84



FEMP-7

WCO-14: Leak Detection

Cost: \$81,167 - Repair

Discounted Savings : \$1,273,225

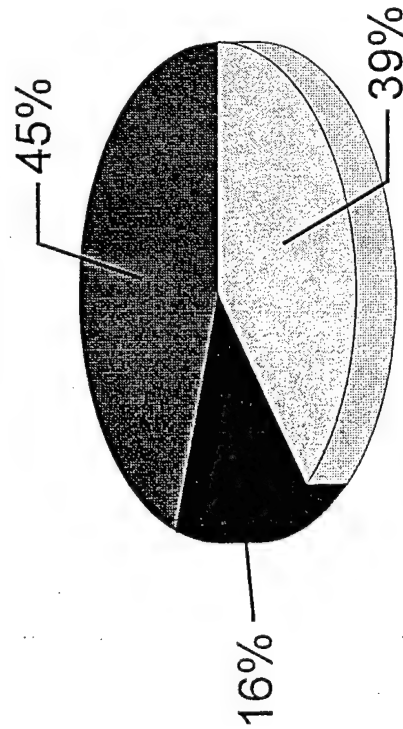
SIR: 15.69

# Cost and SIR by WCO

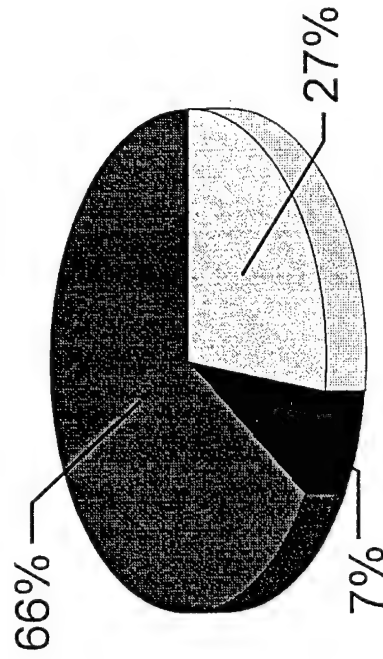
WCO	Cost	SIR
1	\$698,464	2.21
2	3,289	66.55
2FH	70,632	27.88
3	155,072	1.68
3FH	97,746	13.18
4	9,146	3.87
13	38,469	17.84
14	81,167	15.69

# Fort Belvoir Consumption vs Cost

FY 95



Total 1,158,164MBTU's



Total \$10,010,494

■ Electric   ■ Natural Gas   ■ Oil

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# APPENDIX D

Rejected ECOs

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WCO - 3AFH

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LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: 001ECO3A

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID FY95 (92)

INSTALLATION & LOCATION: FT BELVOIR REGION NOS. 3 CENSUS: 3

PROJECT NO. & TITLE: 94013.09 FT BELVOIR WATER CONSERVATION

FISCAL YEAR 1996 DISCRETE PORTION NAME: WATER CLOSET

ANALYSIS DATE: 03-11-96 ECONOMIC LIFE 20 YEARS PREPARED BY: DRISKILL

1. INVESTMENT

A. CONSTRUCTION COST	\$	1148.		
B. SIOH	\$	69.		
C. DESIGN COST	\$	69.		
D. TOTAL COST (1A+1B+1C)	\$	1286.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.		
F. PUBLIC UTILITY COMPANY REBATE	\$	0.		
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		1286.	

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1993

FUEL	UNIT COST \$/ MWH(1)	SAVINGS MWH/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 47.30	0.	\$ 0.	15.61	\$ 0.
B. DIST	\$ .00	0.	\$ 0.	17.56	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	19.97	\$ 0.
D. NAT G	\$ .00	0.	\$ 0.	20.96	\$ 0.
E. COAL	\$ .00	0.	\$ 0.	17.58	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	16.12	\$ 0.
M. DEMAND SAVINGS			\$ 0.	14.74	\$ 0.
N. TOTAL		0.	\$ 0.		\$ 0.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)

(1) DISCOUNT FACTOR (TABLE A)

(2) DISCOUNTED SAVING/COST (3A X 3A1)

	\$	70.
14.74	\$	1032.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTOR (3)	DISCOUNTED SAVINGS(+)/ COST(-) (4)
1. REPLACEMENT	\$ 1286.	10	.74	952.
d. TOTAL	\$ 1286.			952.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4) \$ 1983.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS\ ECONOMIC\ LIFE))$  \$ 134.

5. SIMPLE PAYBACK PERIOD (1G/4) 9.58 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 1983.

7. SAVINGS TO INVESTMENT RATIO (SIR) =  $(6 / 1G) =$  1.54  
(IF < 1 PROJECT DOES NOT QUALIFY)

\*\*\*\* Project does not qualify for ECIP funding; 4,5,6 for information only.

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): N/A

FY 95S EEAP FT. BELVOIR WATER CONSERVATION STUDY										1 OF 2			
CALCULATION WORK SHEET 1										DATE: 11 MAR 96			
FACILITY NO.:		QTRS #1		FUNCTION:		FAMILY HOUSING							
		(ASSUME FAMILY OF 6)				BELVOIR VILLAGE							
Occupancy:		FAMILY - 5 BDRM / 3.5 BATH		Operating Hours:		24 HRS - 365 DAYS / YR							
ECO Number	ECO Type	Existing Fixture System	Description	LPM	Retrofitted Fixture System	Description	LPM	Usage	HRS/YR	Fixtures	Quantity	Water Leaks	Eliminated LPY
2 FH	AERATORS		FAUCETS	18.9		INSTALL AERATOR	9.5	29	5				
ECO2 FH TOTAL:				LPF			LPF	#FL/YR	5			0	
3A FH	WATER CLOSETS		AMERICAN STANDARD	13.2		INSTALL NEW 1.6 GPF TLT	6.05	3285	4				
ECO3 FH TOTAL:				LPF									
5 FH	SHOWERS		WITH FLOW CONTROL	7		NO RETROFIT	7		3				
ECO5 FH TOTAL:													
USE FACTORS		1											
AERATORS		Based on (4 Min / Day Running Time / Person) / # of Fixtures											
WATER CLOSETS		Based on (6 Flushes / Person / Day) / # of Fixtures											

**SYSTEMS CORP**

Systems Engineering and Management Corporation, Knoxville, TN

FY95S EEAP FT. BELVOIR WATER CONSERVATION STUDY										2 OF 2	
CALCULATION WORK SHEET 2											
FACILITY NO.: QTRS #1		Wtr/Swrg Rate: 0.74 \$/KL		Energy Rate: 0.0473 \$/KWH							
		Gas Rate: 18.19 \$/MWH		Demand Rate: \$/KW							
ECO Number ECO Type	Annual Water Saving LPY	Annual Energy Savings			WATER Dollar Saving	Total Dollar Saving	Total Dollars Invested				
		ELEC KW	ELEC KWH	GAS MWH							
2 FH AERATORS	81,780		670		\$60.68	\$92.39	\$51.00				
ECO2 FH TOTAL:	81,780		670	0	\$60.68	\$92.39	\$51.00				
3A FH WATER CLOSETS	94,345				\$70.00	\$70.00	\$1,148.00				
ECO3 FH TOTAL:	94,345		0	0	\$70.00	\$70.00	\$1,148.00				
5 FH SHOWERS	0			0	\$0.00	\$0.00	\$0.00				
ECO5 FH TOTAL:	0				\$0.00	\$0.00	\$0.00				

**SYSTEMS CORP**



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Estimate:      WCO - 2 & 3A      Date:      11-Mar-96
Description:    AERATORS & NEW WATER CLOSET - FAMILY HOUSING
Project:        LIMITED EEAP (WTR) Bid Date:
Location:       FORT BELVOIR, VA  Job #:      94013.09
Sq. footage:    UNIT # 1          City indx: Alexandria, VA
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Line #	Description	Manhours	Matl	Labor	Equipment	Sub	Total
1511412805	WCO - 2 FH, INSTALL AERATOR, LAVATORY FAUCET					5.00 Ea.	
Unit values		0.25	1.00	5.27	0.00	0.00	6.27
Totals		1.25	\$5	\$26	\$0	\$0	\$31
1521801100	WCO - 3A FH, INSTALL NEW WTR SAVING WTR CLOSET, TANK TYPE FLR MNTD, 2PC WHITE W/SEAT, 1.6 GPF					4.00 Ea.	
Unit values		3.02	123.00	62.45	0.00	0.00	185.45
Totals		12.08	\$492	\$250	\$0	\$0	\$742
U15 MECHANICAL		14	\$497	\$276	\$0	\$0	\$773

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=====
Line #      Description
-----
           Manhours  Matl    Labor  Equipment  Sub    Total
=====
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ESTIMATE TOTAL	14	\$497	\$276	\$0	\$0	\$773
SALES TAX	4.50%	\$22				
MATL MARKUP	11.00%	\$55				
LABOR MARKUP	33.00%		\$91			
EQUIPT MARKUP	5.00%			\$0		
SUB MARKUP	5.00%				\$0	
TOTAL BEFORE CONTINGENC		\$574	\$367	\$0	\$0	\$941
CONTINGENCY	10.00%					\$94
BOND	2.50%					\$24
PROFIT	15.00%					\$141
JOB TOTAL						\$1,200

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=====
Estimate:      WCO - 2 & 3A      Date:      11-Mar-96
Description:   AERATORS & NEW WATER CLOSET - FAMILY HOUSING
Project:      LIMITED EEAP (WTR) Bid Date:
Location:     FORT BELVOIR, VA  Job #:      94013.09
Sq. footage:  UNIT # 1          City indx: Alexandria, VA
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## SUMMARY

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              Manhours   Matl     Labor   Equipment   Sub       Total
=====
U15 MECHANICAL      14       $497     $276         $0         $0       $773
TOTAL                14       $497     $276         $0         $0       $773

SALES TAX           4.50%       $22
MATL MARKUP         11.00%      $55
LABOR MARKUP        33.00%           $91
EQUIPT MARKUP       5.00%           $0
SUB MARKUP          5.00%           $0

TOTAL BEFORE CONTINGENC   $574     $367         $0         $0       $941
CONTINGENCY            10.00%           $94
BOND                   2.50%           $24
PROFIT                 15.00%          $141

JOB TOTAL                                           $1,200

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LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: 0150CO3A

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID FY95 (92)

INSTALLATION & LOCATION: FT BELVOIR REGION NOS. 3 CENSUS: 3

PROJECT NO. & TITLE: 94013.09 FT BELVOIR WATER CONSERVATION

FISCAL YEAR 1996 DISCRETE PORTION NAME: WATER CLOSET

ANALYSIS DATE: 03-11-96 ECONOMIC LIFE 20 YEARS PREPARED BY: DRISKILL

1. INVESTMENT

A. CONSTRUCTION COST	\$	574.		
B. SIOH	\$	35.		
C. DESIGN COST	\$	35.		
D. TOTAL COST (1A+1B+1C)	\$	644.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.		
F. PUBLIC UTILITY COMPANY REBATE	\$	0.		
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		644.	

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1993

FUEL	UNIT COST \$/ MWH(1)	SAVINGS MWH/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 47.30	0.	\$ 0.	15.61	\$ 0.
B. DIST	\$ .00	0.	\$ 0.	17.56	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	19.97	\$ 0.
D. NAT G	\$ .00	0.	\$ 0.	20.96	\$ 0.
E. COAL	\$ .00	0.	\$ 0.	17.58	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	16.12	\$ 0.
M. DEMAND SAVINGS			\$ 0.	14.74	\$ 0.
N. TOTAL		0.	\$ 0.		\$ 0.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)

(1) DISCOUNT FACTOR (TABLE A)

14.74 \$ 58.

(2) DISCOUNTED SAVING/COST (3A X 3A1)

\$ 860.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) / COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+) / COST(-) (4)
1. REPLACEMENT	\$ 644.	10	.74	477.
d. TOTAL	\$ 644.			477.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+) / COST(-) (3A2+3Bd4) \$ 1336.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS\ ECONOMIC\ LIFE))$  \$ 91.

5. SIMPLE PAYBACK PERIOD (1G/4) 7.11 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 1336.

7. SAVINGS TO INVESTMENT RATIO (SIR) =  $(6 / 1G) =$  2.08  
(IF < 1 PROJECT DOES NOT QUALIFY)

\*\*\*\* Project does not qualify for ECIP funding; 4,5,6 for information only.

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): N/A

FY 95S EEAP FT. BELVOIR WATER CONSERVATION STUDY										1 OF 2	
CALCULATION WORK SHEET 1										DATE: 11 MAR 96	
FACILITY NO.:		QTRS #150		FUNCTION:		FAMILY HOUSING					
		(ASSUME FAMILY OF 5)				GERBER VILLAGE					
Occupancy:		FAMILY - 4 BDRM / 1.75 BATH		Operating Hours:		24 HRS - 365 DAYS / YR					
ECO Number	ECO Type	Existing Fixture System		Retrofitted Fixture System		Usage	Fixtures	Water Leaks			
		Description	LPM	Description	LPM	HRS/YR	Quantity	Eliminated LPY			
2 FH											
AERATORS		FAUCETS	18.9	INSTALL AERATOR	9.5	41	3				
ECO2 FH TOTAL:			LPF		LPF	#FL/YR	3	0			
3A FH											
WATER CLOSETS		AMERICAN STANDARD	13.2	INSTALL NEW 1.6 GPF TLT	6.05	5475	2				
ECO3 FH TOTAL:			LPM		LPM	HRS/YR	2	0			
5 FH											
SHOWERS		WITH FLOW CONTROL	7	NO RETROFIT	7		2				
ECO5 FH TOTAL:							2	0			
USE FACTORS											
AERATORS		Based on (4 Min / Day Running Time / Person) / # of Fixtures									
WATER CLOSETS		Based on (6 Flushes / Person / Day) / # of Fixtures									

**SYSTEMS CORP**

Systems Engineering and Management Corporation, Knoxville, TN

FY95S EEAP FT. BELVOIR WATER CONSERVATION STUDY										2 OF 2			
CALCULATION WORK SHEET 2													
FACILITY NO. : QTRS #150		Wtr/Swng Rate:		0.74		\$/KL		Energy Rate:		0.0473		\$/KWH	
		Gas Rate:		18.19		\$/MWH		Demand Rate:				\$/KW	
ECO Number	Annual Water	Annual Energy Savings			WATER	Total	Total	Total	Dollars Invested				
ECO Type	Saving LPY	ELEC KW	ELEC KWH	GAS MWH						Dollar Saving	Dollar Saving	Dollars	
2 FH													
AERATORS	69,372		569		\$51.47		\$78.38		\$32.00				
ECO2 FH TOTAL:	69,372		569	0	\$51.47		\$78.38		\$32.00				
3A FH													
WATER CLOSETS	78,621				\$58.34		\$58.34		\$574.00				
ECO3 FH TOTAL:	78,621		0	0	\$58.34		\$58.34		\$574.00				
5 FH													
SHOWERS	0			0	\$0.00		\$0.00		\$0.00				
ECO5 FH TOTAL:	0				\$0.00		\$0.00		\$0.00				

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Estimate:      WCO - 2 & 3A      Date:      11-Mar-96
Description:   AERATORS & NEW WATER CLOSET - FAMILY HOUSING
Project:      LIMITED EEAP (WTR) Bid Date:
Location:     FORT BELVOIR, VA  Job #:      94013.09
Sq. footage:  UNIT 150          City indx: Alexandria, VA
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Line #	Description	Manhours	Matl	Labor	Equipment	Sub	Total
1511412805	WCO - 2 FH, INSTALL AERATOR, LAVATORY FAUCET						
						3.00 Ea.	
Unit values		0.25	1.00	5.27	0.00	0.00	6.27
Totals		0.75	\$3	\$16	\$0	\$0	\$19
1521801100	WCO - 3A FH, INSTALL NEW WTR SAVING WTR CLOSET, TANK TYP						
	FLR MNTD, 2PC WHITE W/SEAT, 1.6 GPF					2.00 Ea.	
Unit values		3.02	123.00	62.45	0.00	0.00	185.45
Totals		6.04	\$246	\$125	\$0	\$0	\$371
U15 MECHANICAL		7	\$249	\$141	\$0	\$0	\$390

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Line #      Description
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      Manhours  Matl    Labor  Equipment  Sub    Total
=====
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ESTIMATE TOTAL	7	\$249	\$141	\$0	\$0	\$390
SALES TAX	4.50%	\$11				
MATL MARKUP	11.00%	\$27				
LABOR MARKUP	33.00%		\$47			
EQUIPT MARKUP	5.00%			\$0		
SUB MARKUP	5.00%				\$0	
TOTAL BEFORE CONTINGENC		\$288	\$188	\$0	\$0	\$475
CONTINGENCY	10.00%					\$48
BOND	2.50%					\$12
PROFIT	15.00%					\$71
JOB TOTAL						\$606



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Estimate:      WCO - 2 & 3A      Date:      11-Mar-96
Description:    AERATORS & NEW WATER CLOSET - FAMILY HOUSING
Project:        LIMITED EEAP (WTR) Bid Date:
Location:       FORT BELVOIR, VA  Job #:      94013.09
Sq. footage:    UNIT 150          City indx: Alexandria, VA
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## SUMMARY

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              Manhours    Matl      Labor    Equipment    Sub      Total
=====
U15 MECHANICAL      7      $249      $141          $0          $0      $390
TOTAL                7      $249      $141          $0          $0      $390

SALES TAX           4.50%      $11
MATL MARKUP         11.00%      $27
LABOR MARKUP        33.00%          $47
EQUIPT MARKUP        5.00%          $0
SUB MARKUP           5.00%          $0

TOTAL BEFORE CONTINGENC      $288      $188          $0          $0      $475
CONTINGENCY           10.00%          $48
BOND                  2.50%          $12
PROFIT                15.00%          $71

JOB TOTAL                                $606

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WCO - 16

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LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: 247SENS1

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID FY95 (92)

INSTALLATION & LOCATION: FT BELVOIR REGION NOS. 3 CENSUS: 3

PROJECT NO. & TITLE: 94013.09 FT BELVOIR WATER CONSERVATION

FISCAL YEAR 1996 DISCRETE PORTION NAME: LAV FAUCET AUTO SENS

ANALYSIS DATE: 03-11-96 ECONOMIC LIFE 20 YEARS PREPARED BY: JWD

1. INVESTMENT

A. CONSTRUCTION COST	\$	30361.		
B. SIOH	\$	1822.		
C. DESIGN COST	\$	1822.		
D. TOTAL COST (1A+1B+1C)	\$	34005.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.		
F. PUBLIC UTILITY COMPANY REBATE	\$	0.		
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$			34005.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1994

FUEL	UNIT COST \$/ MWH(1)	SAVINGS MWH/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ .00	0.	\$ 0.	15.08	\$ 0.
B. DIST	\$ .00	0.	\$ 0.	18.57	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	21.02	\$ 0.
D. NAT G	\$ 18.19	47.	\$ 862.	18.58	\$ 16023.
E. COAL	\$ .00	0.	\$ 0.	16.83	\$ 0.
F. PPG	\$ .00	0.	\$ 0.	17.38	\$ 0.
M. DEMAND SAVINGS			\$ 0.	14.88	\$ 0.
N. TOTAL		47.	\$ 862.		\$ 16023.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		\$ 3316.
(1) DISCOUNT FACTOR (TABLE A)	14.88	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 49340.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) / COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+) / COST(-) (4)
1. REPLACEMENT	\$ 34005.	10	.74	25164.
d. TOTAL	\$ 34005.			25164.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+) / COST(-) (3A2+3Bd4) \$ 74504.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS\ ECONOMIC\ LIFE))$  \$ 5878.

5. SIMPLE PAYBACK PERIOD (1G/4) 5.78 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 90527.

7. SAVINGS TO INVESTMENT RATIO (SIR) =  $(6 / 1G) =$  2.66  
(IF < 1 PROJECT DOES NOT QUALIFY)

\*\*\*\* Project does not qualify for ECIP funding; 4,5,6 for information only.

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): N/A

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: 247SENS3

LCCID FY95 (92)

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FT BELVOIR      REGION NOS. 3      CENSUS: 3

PROJECT NO. & TITLE: 94013.09      FT BELVOIR WATER CONSERVATION

FISCAL YEAR 1996      DISCRETE PORTION NAME: WC AUTO SENSOR

ANALYSIS DATE: 03-11-96      ECONOMIC LIFE 20 YEARS      PREPARED BY: JWD

1. INVESTMENT

A. CONSTRUCTION COST	\$	16892.		
B. SIOH	\$	1014.		
C. DESIGN COST	\$	1014.		
D. TOTAL COST (1A+1B+1C)	\$	18920.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.		
F. PUBLIC UTILITY COMPANY REBATE	\$	0.		
G. TOTAL INVESTMENT (1D - 1E - 1F)			\$	18920.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1994

FUEL	UNIT COST \$/ MWH(1)	SAVINGS MWH/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT	\$ .00	0.	\$ 0.	15.08	\$ 0.
B. DIST	\$ .00	0.	\$ 0.	18.57	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	21.02	\$ 0.
D. NAT G	\$ 18.19	0.	\$ 0.	18.58	\$ 0.
E. COAL	\$ .00	0.	\$ 0.	16.83	\$ 0.
F. PPG	\$ .00	0.	\$ 0.	17.38	\$ 0.
M. DEMAND SAVINGS			\$ 0.	14.88	\$ 0.
N. TOTAL		0.	\$ 0.		\$ 0.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		\$ 807.
(1) DISCOUNT FACTOR (TABLE A)	14.88	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 12010.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) / COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+) / COST(-) (4)
1. REPLACEMENT	\$ 18920.	10	.74	14001.
d. TOTAL	\$ 18920.			14001.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+) / COST(-) (3A2+3Bd4) \$ 26012.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$  \$ 1753.

5. SIMPLE PAYBACK PERIOD (1G/4) 10.79 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 26012.

7. SAVINGS TO INVESTMENT RATIO (SIR) = (6 / 1G) = 1.37  
(IF < 1 PROJECT DOES NOT QUALIFY)

\*\*\*\* Project does not qualify for ECIP funding; 4,5,6 for information only.

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): N/A

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: 247SENS4  
LCCID FY95 (92)

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FT BELVOIR      REGION NOS. 3      CENSUS: 3

PROJECT NO. & TITLE: 94013.09      FT BELVOIR WATER CONSERVATION

FISCAL YEAR 1996      DISCRETE PORTION NAME: URINAL AUTO SENSOR

ANALYSIS DATE: 03-11-96      ECONOMIC LIFE 20 YEARS      PREPARED BY: JWD

1. INVESTMENT

A. CONSTRUCTION COST	\$	9213.	
B. SIOH	\$	553.	
C. DESIGN COST	\$	553.	
D. TOTAL COST (1A+1B+1C)	\$	10319.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.	
F. PUBLIC UTILITY COMPANY REBATE	\$	0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		10319.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1994

FUEL	UNIT COST \$/ MWH (1)	SAVINGS MWH/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT	\$ .00	0.	\$ 0.	15.08	\$ 0.
B. DIST	\$ .00	0.	\$ 0.	18.57	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	21.02	\$ 0.
D. NAT G	\$ 18.19	0.	\$ 0.	18.58	\$ 0.
E. COAL	\$ .00	0.	\$ 0.	16.83	\$ 0.
F. PPG	\$ .00	0.	\$ 0.	17.38	\$ 0.
M. DEMAND SAVINGS			\$ 0.	14.88	\$ 0.
N. TOTAL		0.	\$ 0.		\$ 0.

3. NON ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)

(1) DISCOUNT FACTOR (TABLE A)	14.88	\$	0.
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$	0.

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS (+) COST (-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS (+) / COST (-) (4)
1. REPLACEMENT	\$ 10319.	10	.74	7636.
d. TOTAL	\$ 10319.			7636.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2+3Bd4) \$ 7636.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$  \$ 516.

5. SIMPLE PAYBACK PERIOD (1G/4) 20.00 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 7636.

7. SAVINGS TO INVESTMENT RATIO (SIR) =  $(6 / 1G) = .74$   
(IF < 1 PROJECT DOES NOT QUALIFY)

\*\*\*\* Project does not qualify for ECIP funding; 4,5,6 for information only.

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): N/A

```

=====
Estimate:      WCO - 16          Date:      11-Mar-96
Description:    UPGRADE FAUCETS, WATER CLOSETS, & URINALS W/ SENSORS
Project:        LIMITED EEAP (WTR) Bid Date:
Location:       FORT BELVOIR, VA  Job #:      94013.09
Sq. footage:    BLDG 247         City indx: Alexandria, VA
=====

```

Line #	Description	Manhours	Matl	Labor	Equipment	Sub	Total
0913100200	FEEDER INSTALLATION, INCLUDING CONDUIT AND WIRE, 60 AMPERES					400.00 L.F.	
Unit values		0.15	2.64	5.31	0.00	0.00	7.95
Totals		59.60	\$1,057	\$2,123	\$0	\$0	\$3,180
A09 ELECTRICAL		60	\$1,057	\$2,123	\$0	\$0	\$3,180

=====							
Line #	Description						
-----							
	Manhours	Matl	Labor	Equipment	Sub	Total	
=====							
1511410972	WCO - 3	INSTALL AUTO FLUSH SENSOR AND OPERATOR FOR WATER CLOSETS INCLUDING REMOVAL OF EXISTING			30.00	Ea.	
Unit values	1.50	256.00	41.14	0.00	0.00	297.14	
Totals	45.00	\$7,680	\$1,234	\$0	\$0	\$8,914	
1511410972	WCO - 4	INSTALL AUTO FLUSH SENSOR AND OPERATOR FOR URINAL INCLUDING REMOVAL OF EXISTING			16.00	Ea.	
Unit values	1.64	256.00	48.65	0.00	0.00	304.65	
Totals	26.24	\$4,096	\$778	\$0	\$0	\$4,874	
1511412800	WCO - 2, INSTALL AERATOR, MISCELLANEOUS SINKS					9.00	Ea.
Unit values	0.25	1.00	5.27	0.00	0.00	6.27	
Totals	2.25	\$9	\$47	\$0	\$0	\$56	
1511412810	WCO - 1	INSTALL LAV FAUCET W/ AUTO SENSOR AND OPERATOR INCLUDING REMOVAL OF EXISTING			35.00	Ea.	
Unit values	2.30	262.00	59.67	0.00	0.00	321.67	
Totals	80.50	\$9,170	\$2,089	\$0	\$0	\$11,259	
1554717520	SOLENOID VALVE FOR LAV FAUCET					35.00	Ea.
Unit values	0.89	156.00	20.28	0.00	0.00	176.28	
Totals	31.12	\$5,460	\$710	\$0	\$0	\$6,170	
U15 MECHANICAL	186	\$26,415	\$4,858	\$0	\$0	\$31,273	

Line #	Description					
	Manhours	Matl	Labor	Equipment	Sub	Total
=====						
1621100200	OUTLET BOX STEEL 4" SQUARE EXT					
					20.00 Ea.	
Unit values	0.20	1.88	5.03	0.00	0.00	6.91
Totals	4.00	\$38	\$101	\$0	\$0	\$139
1623104200	LO VOLT TRANSFORMER 115V TO 25V					
					20.00 Ea.	
Unit values	0.67	77.12	16.79	0.00	0.00	93.91
Totals	13.34	\$1,542	\$336	\$0	\$0	\$1,878
1623202480	OUTLET, GROUND FAULT INDICATING, 15 AMP					
					20.00 Ea.	
Unit values	0.30	26.99	7.46	0.00	0.00	34.45
Totals	5.92	\$540	\$149	\$0	\$0	\$689
1623204920	COVER PL. STAINLESS STL NEMA 5&6					
					20.00 Ea.	
Unit values	0.10	2.22	2.52	0.00	0.00	4.73
Totals	2.00	\$44	\$50	\$0	\$0	\$94
U16 ELECTRICAL	26	\$2,164	\$636	\$0	\$0	\$2,800



```
=====
Line #      Description
-----
      Manhours   Matl      Labor   Equipment   Sub      Total
=====
```

ESTIMATE TOTAL	272	\$29,636	\$7,617	\$0	\$0	\$37,253
SALES TAX	4.50%	\$1,334				
MATL MARKUP	11.00%	\$3,260				
LABOR MARKUP	33.00%		\$2,514			
EQUIPT MARKUP	5.00%			\$0		
SUB MARKUP	5.00%				\$0	
TOTAL BEFORE CONTINGENC		\$34,230	\$10,131	\$0	\$0	\$44,360
CONTINGENCY	10.00%					\$4,436
BOND	2.50%					\$1,109
PROFIT	15.00%					\$6,654
JOB TOTAL						\$56,559

```

=====
Estimate:      WCO - 16          Date:      11-Mar-96
Description:   UPGRADE FAUCETS, WATER CLOSETS, & URINALS W/ SENSORS
Project:      LIMITED EEAP (WTR) Bid Date:
Location:     FORT BELVOIR, VA  Job #:      94013.09
Sq. footage:  BLDG  247        City indx: Alexandria, VA
=====

```

## SUMMARY

```

-----
              Manhours   Matl     Labor   Equipment   Sub       Total
=====
A09 ELECTRICAL      60     $1,057   $2,123         $0         $0     $3,180
U15 MECHANICAL     186    $26,415   $4,858         $0         $0    $31,273
U16 ELECTRICAL      26     $2,164    $636          $0         $0     $2,800

TOTAL              272    $29,636   $7,617         $0         $0    $37,253

SALES TAX           4.50%     $1,334
MATL MARKUP        11.00%     $3,260
LABOR MARKUP       33.00%           $2,514
EQUIPT MARKUP       5.00%           $0
SUB MARKUP          5.00%           $0

TOTAL BEFORE CONTINGENC $34,230   $10,131         $0         $0    $44,360
CONTINGENCY         10.00%           $4,436
BOND                 2.50%           $1,109
PROFIT              15.00%           $6,654

JOB TOTAL                                     $56,559

```

FY 95S EEAP FT. BELVOIR WATER CONSERVATION STUDY										1 OF 2	
CALCULATION WORK SHEET 1										DATE: 11 MAR 96	
FACILITY NO.:		247		Function: ADMIN - HUMPHREYS HALL							
Occupancy:		FOR WCO - 16		Operating Hours: 8 HRS/DAY		300 DAYS / YEAR					
		490									
WCO Number	Existing Fixture System	LPM	Retrofitted Fixture System	LPM	Usage	Fixtures	Water Leaks				
WCO Type	Description		Description		Hrs/Yr/Fix	Quantity	Eliminated LPY				
1											
Lav Faucets	Dual Control Lav	9.5	Install Lav Faucet W/ Auto Sensor and Operator	1.9	280	35					
WCO1 TOTAL:		LPM		LPM		35	0				
2											
Misc Sinks	Sinks	45.4	Install Aerator	27.2	8	9					
WCO2 TOTAL:		LPF		LPF	#FL/YR	9	0				
3											
Water Closets	Sloan Flush Valve	17.0	Install Auto Flush Sensor and Operator	13.3	9800	30					
WCO3 TOTAL:		LPF		LPF	#FL/YR	30	0				
4											
Urinals	Sloan Flush Valve	5.7	Install Auto Flush Sensor and Operator	5.7		16					
WCO4 TOTAL:		LPM		LPM	HRS/YR	16	0				
5											
Shower Heads											
USE FACTORS											
Lav Faucets	Based on (4 Min / Day Running Time / Person) / # of Fixtures										
Misc Sinks	Based on (15 Min / Day) / # of Fixtures										
Water Closets	Based on (Each Person Flushing Twice Daily) / # of Fixtures										
Urinals	Based on ( Male Bldg Occupants Flushing 3 Times Daily) / # of Fixtures										
	Assuming 50% of Bldg Occupants Are Male										

**SYSTEMS CORP**

Systems Engineering and Management Corporation, Knoxville, TN



LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: 3151SEN1

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID FY95 (92)

INSTALLATION & LOCATION: FT BELVOIR REGION NOS. 3 CENSUS: 3

PROJECT NO. & TITLE: 94013.09 FT BELVOIR WATER CONSERVATION

FISCAL YEAR 1996 DISCRETE PORTION NAME: LAV FAUCET AUTO SENS

ANALYSIS DATE: 03-11-96 ECONOMIC LIFE 20 YEARS PREPARED BY: JWD

1. INVESTMENT

A. CONSTRUCTION COST	\$	6062.	
B. SIOH	\$	364.	
C. DESIGN COST	\$	364.	
D. TOTAL COST (1A+1B+1C)	\$	6790.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.	
F. PUBLIC UTILITY COMPANY REBATE	\$	0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		6790.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1994

FUEL	UNIT COST \$/ MWH (1)	SAVINGS MWH/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT	\$ .00	0.	\$ 0.	15.08	\$ 0.
B. DIST	\$ .00	0.	\$ 0.	18.57	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	21.02	\$ 0.
D. NAT G	\$ 18.19	3.	\$ 62.	18.58	\$ 1146.
E. COAL	\$ .00	0.	\$ 0.	16.83	\$ 0.
F. PPG	\$ .00	0.	\$ 0.	17.38	\$ 0.
M. DEMAND SAVINGS			\$ 0.	14.88	\$ 0.
N. TOTAL		3.	\$ 62.		\$ 1146.

3. NON ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)		\$	237.
(1) DISCOUNT FACTOR (TABLE A)	14.88		
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$	3524.

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS (+) COST (-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS (+) / COST (-) (4)
1. REPLACEMENT	\$ 6790.	10	.74	5024.
d. TOTAL	\$ 6790.			5024.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2+3Bd4) \$ 8549.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS\ ECONOMIC\ LIFE))$  \$ 638.

5. SIMPLE PAYBACK PERIOD (1G/4) 10.64 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 9694.

7. SAVINGS TO INVESTMENT RATIO (SIR) = (6 / 1G) = 1.43  
(IF < 1 PROJECT DOES NOT QUALIFY)

\*\*\*\* Project does not qualify for ECIP funding; 4,5,6 for information only.

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): N/A

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: 3151SEN3

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID FY95 (92)

INSTALLATION & LOCATION: FT BELVOIR REGION NOS. 3 CENSUS: 3

PROJECT NO. & TITLE: 94013.09 FT BELVOIR WATER CONSERVATION

FISCAL YEAR 1996 DISCRETE PORTION NAME: WC AUTO SENSOR

ANALYSIS DATE: 03-11-96 ECONOMIC LIFE 20 YEARS PREPARED BY: JWD

1. INVESTMENT

A. CONSTRUCTION COST	\$	9986.		
B. SIOH	\$	600.		
C. DESIGN COST	\$	600.		
D. TOTAL COST (1A+1B+1C)	\$	11186.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.		
F. PUBLIC UTILITY COMPANY REBATE	\$	0.		
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		11186.	

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1994

FUEL	UNIT COST \$/ MWH(1)	SAVINGS MWH/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT	\$ .00	0.	\$ 0.	15.08	\$ 0.
B. DIST	\$ .00	0.	\$ 0.	18.57	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	21.02	\$ 0.
D. NAT G	\$ 18.19	0.	\$ 0.	18.58	\$ 0.
E. COAL	\$ .00	0.	\$ 0.	16.83	\$ 0.
F. PPG	\$ .00	0.	\$ 0.	17.38	\$ 0.
M. DEMAND SAVINGS			\$ 0.	14.88	\$ 0.
N. TOTAL		0.	\$ 0.		\$ 0.

3. NON ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)		\$	58.
(1) DISCOUNT FACTOR (TABLE A)	14.88		
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$	858.

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS (+) COST (-)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS (+) / COST (-) (4)
1. REPLACEMENT	\$ 11186.	10	.74	8278.
d. TOTAL	\$ 11186.			8278.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2+3Bd4) \$ 9135.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS\ ECONOMIC\ LIFE))$  \$ 617.

5. SIMPLE PAYBACK PERIOD (1G/4) 18.13 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 9135.

7. SAVINGS TO INVESTMENT RATIO (SIR) = (6 / 1G) = .82  
(IF < 1 PROJECT DOES NOT QUALIFY)

\*\*\*\* Project does not qualify for ECIP funding; 4,5,6 for information only.

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): N/A

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: 3151SEN4

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)      LCCID    FY95 (92)

INSTALLATION & LOCATION: FT BELVOIR      REGION NOS.    3    CENSUS: 3

PROJECT NO. & TITLE: 94013.09      FT BELVOIR WATER CONSERVATION

FISCAL YEAR 1996      DISCRETE PORTION NAME: URINAL AUTO SENSOR

ANALYSIS DATE: 03-11-96    ECONOMIC LIFE 20 YEARS    PREPARED BY: JWD

1. INVESTMENT

A. CONSTRUCTION COST	\$	3683.		
B. SIOH	\$	221.		
C. DESIGN COST	\$	221.		
D. TOTAL COST (1A+1B+1C)	\$	4125.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.		
F. PUBLIC UTILITY COMPANY REBATE	\$	0.		
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		4125.	

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS    OCT 1994

FUEL	UNIT COST \$/ MWH (1)	SAVINGS MWH/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT	\$ .00	0.	\$ 0.	15.08	\$ 0.
B. DIST	\$ .00	0.	\$ 0.	18.57	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	21.02	\$ 0.
D. NAT G	\$ 18.19	0.	\$ 0.	18.58	\$ 0.
E. COAL	\$ .00	0.	\$ 0.	16.83	\$ 0.
F. PPG	\$ .00	0.	\$ 0.	17.38	\$ 0.
M. DEMAND SAVINGS			\$ 0.	14.88	\$ 0.
N. TOTAL		0.	\$ 0.		\$ 0.

3. NON ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)		\$	67.
(1) DISCOUNT FACTOR (TABLE A)		14.88	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$	991.

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS (+) COST (-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS (+) / COST (-) (4)
1. REPLACEMENT	\$ 4125.	10	.74	3052.
d. TOTAL	\$ 4125.			3052.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2+3Bd4) \$ 4043.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$  \$ 273.

5. SIMPLE PAYBACK PERIOD (1G/4) 15.12 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 4043.

7. SAVINGS TO INVESTMENT RATIO (SIR) =  $(6 / 1G) = .98$   
(IF < 1 PROJECT DOES NOT QUALIFY)

\*\*\*\* Project does not qualify for ECIP funding; 4,5,6 for information only.

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): N/A

```
=====
Estimate:      WCO - 16          Date:      11-Mar-96
Description:    UPGRADE FAUCETS, WATER CLOSETS, & URINALS W/ SENSORS
Project:       LIMITED EEAP (WTR) Bid Date:
Location:      FORT BELVOIR, VA  Job #:      94013.09
Sq. footage:   BLDG 3151        City indx: Alexandria, VA
=====
```

Line #	Description	Manhours	Matl	Labor	Equipment	Sub	Total
0913100200	FEEDER INSTALLATION, INCLUDING CONDUIT AND WIRE, 60 AMPERES					550.00 L.F.	
Unit values		0.15	2.64	5.31	0.00	0.00	7.95
Totals		81.95	\$1,453	\$2,919	\$0	\$0	\$4,372
A09 ELECTRICAL		82	\$1,453	\$2,919	\$0	\$0	\$4,372



=====						
Line #	Description					
	Manhours	Matl	Labor	Equipment	Sub	Total
=====						
1511410972	WCO - 3 INSTALL AUTO FLUSH SENSOR AND OPERATOR FOR WATER CLOSETS INCLUDING REMOVAL OF EXISTING					
					11.00 Ea.	
Unit values	1.50	256.00	41.14	0.00	0.00	297.14
Totals	16.50	\$2,816	\$453	\$0	\$0	\$3,269
1511410972	WCO - 4 INSTALL AUTO FLUSH SENSOR AND OPERATOR FOR URINAL INCLUDING REMOVAL OF EXISTING					
					4.00 Ea.	
Unit values	1.64	256.00	48.65	0.00	0.00	304.65
Totals	6.56	\$1,024	\$195	\$0	\$0	\$1,219
1511412800	WCO - 2, INSTALL AERATOR, MISCELLANEOUS SINKS					
					5.00 Ea.	
Unit values	0.25	1.00	5.27	0.00	0.00	6.27
Totals	1.25	\$5	\$26	\$0	\$0	\$31
1511412810	WCO - 1 INSTALL LAV FAUCET W/ AUTO SENSOR AND OPERATOR INCLUDING REMOVAL OF EXISTING					
					5.00 Ea.	
Unit values	2.30	262.00	59.67	0.00	0.00	321.67
Totals	11.50	\$1,310	\$298	\$0	\$0	\$1,608
1554717520	SOLENOID VALVE FOR LAV FAUCET					
					5.00 Ea.	
Unit values	0.89	156.00	20.28	0.00	0.00	176.28
Totals	4.45	\$780	\$101	\$0	\$0	\$881
U15 MECHANICAL	41	\$5,935	\$1,073	\$0	\$0	\$7,008

=====						
Line #	Description					
-----						
	Manhours	Matl	Labor	Equipment	Sub	Total
=====						
1621100200	OUTLET BOX STEEL 4" SQUARE EXT					
					10.00 Ea.	
Unit values	0.20	1.88	5.03	0.00	0.00	6.91
Totals	2.00	\$19	\$50	\$0	\$0	\$69
1623104200	LO VOLT TRANSFORMER 115V TO 25V					
					10.00 Ea.	
Unit values	0.67	77.12	16.79	0.00	0.00	93.91
Totals	6.67	\$771	\$168	\$0	\$0	\$939
1623202480	OUTLET, GROUND FAULT INDICATING, 15 AMP					
					10.00 Ea.	
Unit values	0.30	26.99	7.46	0.00	0.00	34.45
Totals	2.96	\$270	\$75	\$0	\$0	\$345
1623204920	COVER PL. STAINLESS STL NEMA 5&6					
					10.00 Ea.	
Unit values	0.10	2.22	2.52	0.00	0.00	4.73
Totals	1.00	\$22	\$25	\$0	\$0	\$47
U16 ELECTRICAL	13	\$1,082	\$318	\$0	\$0	\$1,400

```
=====
Line #      Description
-----
      Manhours  Matl    Labor  Equipment  Sub    Total
=====
```

ESTIMATE TOTAL	136	\$8,470	\$4,310	\$0	\$0	\$12,780
SALES TAX	4.50%	\$381				
MATL MARKUP	11.00%	\$932				
LABOR MARKUP	33.00%		\$1,422			
EQUIPT MARKUP	5.00%			\$0		
SUB MARKUP	5.00%				\$0	
TOTAL BEFORE CONTINGENC		\$9,783	\$5,732	\$0	\$0	\$15,515
CONTINGENCY	10.00%					\$1,552
BOND	2.50%					\$388
PROFIT	15.00%					\$2,327
JOB TOTAL						\$19,782

```

=====
Estimate:      WCO - 16          Date:      11-Mar-96
Description:   UPGRADE FAUCETS, WATER CLOSETS, & URINALS W/ SENSORS
Project:      LIMITED EEAP (WTR) Bid Date:
Location:     FORT BELVOIR, VA  Job #:      94013.09
Sq. footage:  BLDG 3151        City indx: Alexandria, VA
=====

```

## SUMMARY

```

-----
              Manhours   Matl      Labor   Equipment   Sub      Total
=====
A09 ELECTRICAL      82      $1,453    $2,919         $0         $0      $4,372
U15 MECHANICAL      41      $5,935    $1,073         $0         $0      $7,008
U16 ELECTRICAL      13      $1,082     $318         $0         $0      $1,400
TOTAL                136      $8,470    $4,310         $0         $0     $12,780

SALES TAX           4.50%      $381
MATL MARKUP         11.00%     $932
LABOR MARKUP        33.00%     $1,422
EQUIPT MARKUP        5.00%         $0
SUB MARKUP           5.00%         $0

TOTAL BEFORE CONTINGENC  $9,783    $5,732         $0         $0     $15,515
CONTINGENCY          10.00%         $1,552
BOND                  2.50%         $388
PROFIT               15.00%         $2,327
JOB TOTAL                                     $19,782

```

FY 95S EEAP FT. BELVOIR WATER CONSERVATION STUDY										1 OF 2	
CALCULATION WORK SHEET 1										DATE: 11 MAR 96	
FACILITY NO.:		3151		Function: Rotary Wing Maintenance							
Occupancy:		FOR WCO - 16		Operating Hours: 9.5 HRS/DAY		300 DAYS / YEAR					
		35									
WCO Number	WCO Type	Existing Fixture System	LPM	Retrofitted Fixture System	LPM	Usage	Fixtures	Water Leaks			
1	Lav Faucets	Dual Control Lav	9.5	Install Lav Faucet w/ Auto Sensor and Operator	1.9	140	5				
WCO1 TOTAL:			LPM		LPM		5	0			
2	Misc Sinks	Sinks	45.4	Install Aerator	27.2	15	5				
WCO2 TOTAL:			LPM		LPM		5	0			
3	Water Closets	Sloan Flush Valve	17.0	Install Auto Flush Sensor and Operator	13.3	1909	11				
WCO3 TOTAL:			LPM		LPM		11	0			
4	Urinals	Standard Flush Valve	11.4	Install Auto Flush Sensor and Operator	5.7	3938	4				
WCO4 TOTAL:			LPM		LPM		4	0			
5	Shower Heads	With Flow Control	7.0	No Retrofit	7.0		1				
		No Flow Control	16.1	No Retrofit	16.1		1				
USE FACTORS											
Lav Faucets		Based on (4 Min / Day Running Time / Person) / # of Fixtures									
Misc Sinks		Based on (15 Min / Day) / # of Fixtures									
Water Closets		Based on (Each Person Flushing Twice Daily) / # of Fixtures									
Urinals		Based on ( Male Bldg Occupants Flushing 3 Times Daily) / # of Fixtures									
		Assuming 50% of Bldg Occupants Are Male									

**SYSTEMS CORP**

Systems Engineering and Management Corporation, Knoxville, TN



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# APPENDIX E

## Leak Detection Survey

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Heath Consultants Incorporated

SYSTEMS CORP  
FORT BELVOIR

SAQ SURVEY  
FORT BELVOIR, VA  
1995





Heath Consultants Incorporated

July 24, 1995

Headquarters — Mideast Region  
R.D. #3, Box 325  
Belle Vernon, PA 15012  
412-929-2300  
1-800-HEATH US (432-8487)  
FAX 412-929-4872

Mr. Charles Belt  
Systemscorp  
Cherokee Place, Suite 306  
2200 Sutherland Avenue  
Knoxville, Tenn. 37919

Dear Mr. Belt;

This is the final report of your recently completed Heath Consultants Leakage Detection Survey. The survey was conducted by myself, Donald Muir, Operations Coordinator, and required 12.25 working days. This was not a survey of the entire water distribution system but instead a survey of water mains 8 inch and larger. A total of 31 leaks were detected with an estimated loss of 243 gallons per minute. This would result in a loss of 349,920 gallons per day and a loss of 127,720,800 gallons per year.

The Heath Aqua-Scope was used to perform the survey. The Aqua-Scope is an electro-sonic amplification device capable of detecting leakage as small as 10 gallons per hour. The Aqua-Scope consists of a headset worn by the operator, a direct contact microphone, a ground microphone, and a control console with a volume control and an on/off switch. In addition, a computerized leak correlator was used to pinpoint the location of several leaks.

As with most water systems, the majority of leaks detected were small leaks. 20 of the 31 leaks were either leaking fire hydrants or leaking main valves. Only 1 service line was found leaking. This was a yard hydrant outside of an airplane hanger at the airfield. The small number of service line leaks can be contributed to the fact that the majority of buildings are supplied by mains that are less than 8 inch in diameter and therefore were not part of the leakage detection survey. The remaining 10 leaks were leaks found on the mains themselves. These 10 leaks were responsible for 76% of the total water loss.

It is impossible to stop water system leakage entirely. Proper preventative maintenance of the distribution system and an ongoing leakage detection and repair program can keep leakage to a minimum. Very few water leaks actually appear above ground. The majority of

Northeast Region  
306 E. Main Street  
P.O. Box 511  
Norton, MA 02766

Southeast Region  
135 Space Park Drive  
P.O. Box 110075  
Nashville, TN 37222

Central Southwest Region  
9030 Monroe Road  
P.O. Box 75130  
Houston, TX 77234

Midwest Region  
1655 S. Memorial Drive  
P.O. Box 546  
New Castle, IN 47362

West Region  
501-D Harbor Boulevard  
P.O. Box 1267  
W. Sacramento, CA 95691

Mr. Charles Belt  
July 24, 1995  
Page 2

leaks find their way into the surrounding rock structure or into nearby utility line ditches and never appear above ground.

Knowing this, some type of leakage detection program is needed. The program can be contracted to an outside firm or performed in-house. Detection equipment can be as sophisticated as an Aqua-Scope and leak correlator or as simple as placing your ear onto a valve key and listening for leakage noise. Leakage detection can be incorporated into routine system maintenance. Listening for the presence of leakage noise on fire hydrants during flushing and listening on valve keys while exercising valves will tell if any leaks are nearby. The key to leakage detection is the number of contact points available onto the water line. Therefore it is necessary that all main line valve and service line valves be located and brought to ground level if buried. What must be remembered though is that any type of leakage detection program is better than no leakage detection program.

Several recommendations can be made to improve the water system at Fort Belvoir. They are as follows:

1. Not all large leaks are on large diameter water mains. A comprehensive survey of the remainder of water system should be undertaken.
2. An ongoing leakage detection program must be initiated. This program can be performed in-house or by an outside firm.
3. A large number of the leaks detected were fire hydrant leaks. These hydrants are very old and ideally need replaced. In lieu of this, repairing the leaking hydrants and verifying that hydrants are completely shut off after flushing will reduce water loss.
4. A water system can not have too many valves. All main line valves and service line valves should be located and if buried, valve boxes should be brought up to ground level.
5. During the survey it was found that water mains are exposed at several creek crossings. These lines need to be buried and/or reinforced to prevent damage due to freezing or damage due to foreign objects striking mains.
6. A large amount of the water main on the post runs through wooded areas. Leakage in these areas can occur for long periods of time before being discovered. These lines need to be located, their location marked, and inspected regularly to insure leakage is not present

Mr. Charles Belt  
July 24, 1995  
Page 3

7. Individual buildings on base do not have water meters. Leakage inside the buildings needs to be identified and repaired. Leakage inside the buildings is actually more expensive than underground leakage due to the fact that sewage flow is metered.

Heath Consultants was requested by Fort Belvoir personnel to note during the survey any areas that needed maintenance. The following is a list of such areas.

1. Washington Village - The majority of service line curb boxes are filled with stone and need cleaned out
2. Water main is exposed in creek crossing at intersection of Soldier Road and Statesman Road
3. Both 12 inch mains are exposed at the creek crossing north of Building #1494.
4. 12 inch main exposed in woods behind Building #1422.
5. 12 inch main exposed at blow-off at creek crossing in woods behind Youth Services Center .
6. Head for air release valve on 16 inch main at Cheney School not installed.
7. 10 inch main valve box knocked over in woods behind Building #1000.
8. 10 inch main valve boxes northeast of Building #1000 washed out and missing
9. Main valve box near Building # 2604 paved over.
10. Air release valve at intersection of Abbott Road and Forster Road buried.
11. Main valve boxes at intersection of Gorgas Road and Woodlawn Road buried
12. Blow-off valve along Route 1 at Accotink Creek buried.
13. Could not locate 10 inch main valve boxes on north side of Route 1 at Gunston Road
14. Could not locate main valve boxes on west side of Belvoir Road at Farrell Road near DeWitt Hospital

Mr. Charles Belt  
July 24, 1995  
Page 4

Concern was raised as to whether our leakage detection survey was performed in accordance to the AWWA Standard M-36 "Water Audits and Leak Detection." All Heath Consultants surveys are conducted in accordance to the AWWA Standard M-36. In fact, Mr. Tim Brown of Heath Consultants sits on the Advisory Board overseeing Standard M-36.

Very little survey at Fort Belvoir was performed at night. The water mains running along Route 1 were an exception. Several nights were required to survey along Route 1 since survey could only be performed between the hours of 3:00 a.m. and 5:00 a.m. when traffic was its lightest. The majority of water main at Fort Belvoir does not run under paved road. Most of the line runs in the soil off the road on the road shoulder. Once the morning rush of base employees was over, the base was actually a very quiet place to survey.

Noise created by water consumption was not a problem. A large number of the buildings on base are supplied from water mains that are less than 8 inch in diameter and, therefore, was not part of the survey. Buildings supplied by mains that were surveyed in general do use great amounts of water. Buildings such as classrooms and office buildings in general need water only for restrooms and drinking fountains. In addition, noise created by a water line will be constant. This noise will not stop while noise created by consumption will stop and start indicating to the survey consultant that this noise is not a leak.

It has been a pleasure working with SystemsCorp at Fort Belvoir. If you have any questions on this survey or if we can be of any further service, please do not hesitate to contact our Regional Office at 412-929-2300.

Sincerely,

*Don Muir Jr., ml*

Don Muir Jr.  
Area Operations Coordinator

DM/mh  
cc: File



343-SAQ-0003467-12

REFERENCE NUMBER

Summary of  
**WATER LEAKAGE CONTROL SURVEY**  
FOR

SYSTEMSCORP/FORT BELVOIR  
COMPANY

FORT BELVOIR, VA  
CITY AND STATE

DISTRICT OR DIVISION

Conducted by Our Consultant(s) Donald Muir Jr.

DATE STARTED 6-21-95 DATE COMPLETED 7-17-95 TOTAL DAYS 12.25

CLASSIFICATION	NUMBER	ESTIMATED LEAKAGE			
		GPM	GPD	GPY	AF/Y
1 15 to +15 gpm	4	160 gpm	230,400 gpd	84,096,000 gpy	
2 5 to 14 gpm	4	35 gpm	50,400 gpd	18,396,000 gpy	
3 1 to 4 gpm	23	48 gpm	69,120 gpd	25,228,800 gpy	
TOTALS	31	243 gpm	349,920 gpd	127,720,800 gpy	

GPM = Gallons/Minute

GPD = Gallons/Day

GPY = Gallons/Year

AF/Y = Acre Feet/Year

SOURCE OF LEAKAGE	NUMBER	GPM	% OF TOTAL NO.	% OF TOTAL EST. GPM
MAINS	10	185 gpm	32.3%	76.1%
SERVICES	1	1 gpm	3.2%	0.4%
VALVES	6	14 gpm	19.4%	5.8%
HYDRANTS	14	43 gpm	45.1%	17.7%
TOTALS	31	243 gpm	100.0%	100.0%

TYPE OF SURVEY PERFORMED Comprehensive Water-8" & larger

MILES OF MAIN INSPECTED 32.0 mi.

NUMBER OF SERVICES INSPECTED N/A  
(If applicable)

NUMBER OF LEAK INDICATIONS 31

**LEAK INDICATION CLASSIFICATION**

Leak indication classification is not an exact science. In spite of the use of the most modern instruments plus complete training and experience by the consultant, it is impossible to determine the exact condition of underground piping without actually exposing same. In view of this limitation, our classification (including estimated volume loss) is intended as an aid in scheduling repairs based upon the information available, the consultant's judgement, and site conditions at the time the report is prepared. Variable factors beyond our control may alter this classification at any time. Once the leak is exposed for repair, the utility may wish to revise the volume loss estimate, in order to establish a more accurate estimate of actual water loss.

Grade 1 (C) 15 to +15 GPM  
Grade 2 (B) 5 to 14 GPM  
Grade 3 (A) 1 to 4 GPM

**SPECIAL CASES**

Contact Heath Consultants Incorporated for further information regarding any Special Case such as: emergency assistance, inspecting river/canal crossings, analysis/audit of in-house leakage programs, third party verification, hands-on training, etc.

Our consultants will be available on a 24-hour notice to assist you.

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## Positive Street Reports

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I N D E X

POSITIVE STREET REPORTS

<u>LOCATION</u>	<u>PAGE NO.</u>	<u>LEAK CLASSIFICATION</u>
Abbot Road @ #2115	26	3
Arnold Rd. south of 9th St.	12	2
Belvoir Rd. behind #1000	10	3
12" main valve at Building #1003	14	3
Building T-1426 @ Fire Hydrant	2	3
Davidson Airfield @ #1351	31	3
Davison Airfield @ Building #1357	30	3
Goethals Rd. @ Beauregard Rd.	23	3
Gunston Rd. @ #S-1147	9	2
Guston Rd. @ #1195 - Fire Hydrant	8	3
Gunston Rd. @ Fifth St.	5	3
Hall Rd. @ Bldg. #1464 - Fire Hydrant	4	3
Hurley Road ! #805	15	3
Iry Road @ #1970	24	3
Iry Rd. @ #1972	25	3
Jackson Loop at Building #1434-Valve	3	3
Jackson Loop @ 1440 - Fire Hydrant	1	3
Lyman Loop @ Fire Hydrant	18	1
Meeres Road @ #1741	13	3
Rossell Loop @ 21st St.	21	3
Spengler Loop @ 21st St.	19	2
Theote Rd. near S-628	28	1
Totten Rd. @ #338	29	3
Third St. east of Gunston Rd.	6	3
Third St. west of Chapek St.	7	3
12th St. @ #1017 (Barden School)	11	3
16th St. @ #740	16	1
16th St. @ Building #193	27	2
16th St. west of Dalrymple St.	17	3
18th St. @ Rear of #130	22	3
21st Street @ Rear of #165	20	1



HEATH CONSULTANTS INCORPORATED  
9030 Monroe Road, Houston, TX 77061

Page No. 1

Date 6-21-95

Ownership Public Private Easement

Leak Indication Classification  
I(C) II(B) III(A)  
(Circle One)

## LEAKAGE CONTROL REPORT WATER SURVEY

Company SYSTEMCORP / FULT BELVOIR District \_\_\_\_\_  
City ACCOLINK State VA  
Nearest Street Address

JACKSON LOOP AT 1440 - FINE hydrant

### INDICATION OF LEAK

Sonic	<input checked="" type="checkbox"/>
Surfaced Water	<input type="checkbox"/>
Other	<input type="checkbox"/>

### ESTIMATION OF LEAKAGE:

<u>3 gpm</u>

### LEAKAGE DETECTED AT:

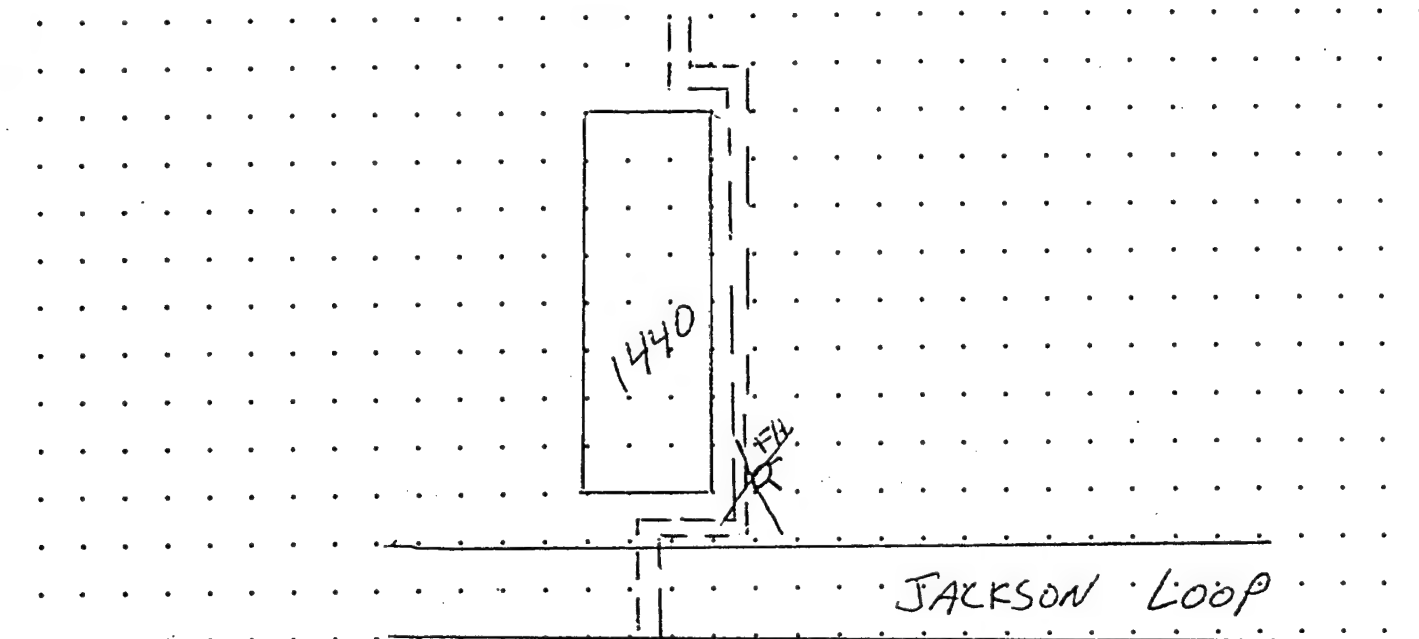
Main Valve	<input type="checkbox"/>
Curb Valve	<input type="checkbox"/>
Meter Box	<input type="checkbox"/>
Selected Test	<input type="checkbox"/>
Hydrant	<input checked="" type="checkbox"/>
	<input type="checkbox"/>
See Remarks	<input type="checkbox"/>

### LEAK APPEARS TO BE ON:

Main	<input type="checkbox"/>
Service	<input type="checkbox"/>
Joint Connection	<input type="checkbox"/>
Hydrant	<input checked="" type="checkbox"/>
Valve	<input type="checkbox"/>
Misc.	<input type="checkbox"/>

### COVER

Concrete	<input type="checkbox"/>
Asphalt	<input type="checkbox"/>
Brick	<input type="checkbox"/>
Gravel	<input type="checkbox"/>
Soil	<input checked="" type="checkbox"/>
Other	<input type="checkbox"/>



### Remarks

FINE hydrant in front of south side of  
#1440 off JACKSON Loop LEAKING

MAP I-7

Daniel Murphy  
Heath Consultant





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9030 Monroe Road, Houston, TX 77061

Page No. 2  
Date 6-21-95  
Ownership Public Private Easement  
Leak Indication Classification  
I(C) II(B) III(A)  
(Circle One)

### LEAKAGE CONTROL REPORT WATER SURVEY

Company Systemcorp / Fort Belvoir District \_\_\_\_\_  
City Alcotink State VA  
Nearest Street Address \_\_\_\_\_

Building T-1426 at Fire hydrant

#### INDICATION OF LEAK

Sonic	<input checked="" type="checkbox"/>
Surfaced Water	<input type="checkbox"/>
Other	<input type="checkbox"/>

#### ESTIMATION OF LEAKAGE:

<u>2 gpm</u>

#### LEAKAGE DETECTED AT:

Main Valve	<input type="checkbox"/>
Curb Valve	<input type="checkbox"/>
Meter Box	<input type="checkbox"/>
Selected Test	<input type="checkbox"/>
Hydrant	<input checked="" type="checkbox"/>
	<input type="checkbox"/>
See Remarks	<input type="checkbox"/>

#### LEAK APPEARS TO BE ON:

Main	<input type="checkbox"/>
Service	<input type="checkbox"/>
Joint Connection	<input type="checkbox"/>
Hydrant	<input checked="" type="checkbox"/>
Valve	<input type="checkbox"/>
Misc.	<input type="checkbox"/>

#### COVER

Concrete	<input type="checkbox"/>
Asphalt	<input checked="" type="checkbox"/>
Brick	<input type="checkbox"/>
Gravel	<input type="checkbox"/>
Soil	<input type="checkbox"/>
Other	<input type="checkbox"/>

#### Remarks

Fire hydrant at west side of Building T-1426  
Leaking

MAP - I-7

[Signature]  
Heath Consultant



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9030 Monroe Road, Houston, TX 77061

Page No. 3  
Date 6-21-95  
Ownership Public Private Easement  
Leak Indication Classification  
1 2 3  
(Circle One)

### LEAKAGE CONTROL REPORT WATER SURVEY

Company System Corp/Four Belvoir District \_\_\_\_\_  
City ALCOOTIC State VA  
Nearest Street Address

JACKSON Loop AT Building # 1434 - VALVE

#### INDICATION OF LEAK

Sonic	<input checked="" type="checkbox"/>
Surfaced Water	<input type="checkbox"/>
Other	<input type="checkbox"/>

#### ESTIMATION OF LEAKAGE:

<u>4 gpm</u>

#### LEAKAGE DETECTED AT:

Main Valve	<input checked="" type="checkbox"/>
Curb Valve	<input type="checkbox"/>
Meter Box	<input type="checkbox"/>
Selected Test	<input type="checkbox"/>
Hydrant	<input type="checkbox"/>
	<input type="checkbox"/>
See Remarks	<input type="checkbox"/>

#### LEAK APPEARS TO BE ON:

Main	<input checked="" type="checkbox"/>
Service	<input checked="" type="checkbox"/>
Joint Connection	<input type="checkbox"/>
Hydrant	<input type="checkbox"/>
Valve	<input checked="" type="checkbox"/>
Misc.	<input type="checkbox"/>

#### COVER

Concrete	<input type="checkbox"/>
Asphalt	<input type="checkbox"/>
Brick	<input type="checkbox"/>
Gravel	<input type="checkbox"/>
Soil	<input checked="" type="checkbox"/>
Other	<input type="checkbox"/>

#### Remarks

VALVE CONTROLLING Flow NORTH ON 8" LINE  
RUNNING ALONG EAST SIDE OF Building 1420 LEAKING. VALVE  
IS OFF SOUTH SIDE OF JACKSON Loop AT Northeast Corner  
of Building #1434

MAP I-8

Daniel Miller  
Heath Consultants



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9030 Monroe Road, Houston, TX 77061

Page No. 4  
Date 4-22-95  
Ownership Public Private Easement  
Leak Indication Classification  
1 2 3  
(Circle One)

### LEAKAGE CONTROL REPORT WATER SURVEY

Company Systemcomp / Fort Belvoir District \_\_\_\_\_  
City ACCO TOWNE State VA  
Nearest Street Address

HALL Road at Bldg # 1464 - FINE hydrant

#### INDICATION OF LEAK

Sonic	<input checked="" type="checkbox"/>
Surfaced Water	<input type="checkbox"/>
Other	<input type="checkbox"/>

#### ESTIMATION OF LEAKAGE:

<u>2 gpm</u>

#### LEAKAGE DETECTED AT:

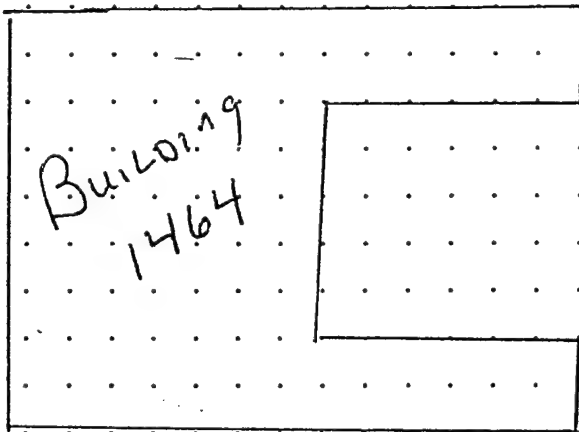
Main Valve	<input type="checkbox"/>
Curb Valve	<input type="checkbox"/>
Meter Box	<input type="checkbox"/>
Selected Test	<input type="checkbox"/>
Hydrant	<input checked="" type="checkbox"/>
See Remarks	<input type="checkbox"/>

#### LEAK APPEARS TO BE ON:

Main	<input type="checkbox"/>
Service	<input type="checkbox"/>
Joint Connection	<input type="checkbox"/>
Hydrant	<input checked="" type="checkbox"/>
Valve	<input type="checkbox"/>
Misc.	<input type="checkbox"/>

#### COVER

Concrete	<input type="checkbox"/>
Asphalt	<input type="checkbox"/>
Brick	<input type="checkbox"/>
Gravel	<input type="checkbox"/>
Soil	<input checked="" type="checkbox"/>
Other	<input type="checkbox"/>



#### Remarks

FINE hydrant on EAST SIDE of Building #1464  
Along HALL Road leaking

MAP I-8

*[Signature]*  
Heath Consultants



HEATH CONSULTANTS INCORPORATED  
9030 Monroe Road, Houston, TX 77061

Page No. 5

Date 6-22-95

Ownership Public Private Easement

Leak Indication Classification  
1 2 3  
(Circle One)

## LEAKAGE CONTROL REPORT WATER SURVEY

Company Systemcomp / Kurt Belvoir District \_\_\_\_\_

City ACCOLINE State VA

Nearest Street Address

Gunston Rd AT FIFTH ST

### INDICATION OF LEAK

Sonic	<input checked="" type="checkbox"/>
Surfaced Water	<input checked="" type="checkbox"/>
Other	<input type="checkbox"/>

### ESTIMATION OF LEAKAGE:

<u>1 g/m</u>

### LEAKAGE DETECTED AT:

Main Valve	<input type="checkbox"/>
Curb Valve	<input type="checkbox"/>
Meter Box	<input type="checkbox"/>
Selected Test	<input type="checkbox"/>
Hydrant	<input checked="" type="checkbox"/>
	<input type="checkbox"/>
See Remarks	<input type="checkbox"/>

### LEAK APPEARS TO BE ON:

Main	<input type="checkbox"/>
Service	<input type="checkbox"/>
Joint Connection	<input type="checkbox"/>
Hydrant	<input checked="" type="checkbox"/>
Valve	<input type="checkbox"/>
Misc.	<input type="checkbox"/>

### COVER

Concrete	<input type="checkbox"/>
Asphalt	<input type="checkbox"/>
Brick	<input type="checkbox"/>
Gravel	<input type="checkbox"/>
Soil	<input checked="" type="checkbox"/>
Other	<input type="checkbox"/>

### Remarks

Fire hydrant AT intersection of Gunston Rd  
& FIFTH ST LEAKING

I-8

Daniel C. [Signature]  
Heath Consultants



HEATH CONSULTANTS INCORPORATED  
9030 Monroe Road, Houston, TX 77061

Page No. 6

Date 6-22-95

Ownership Public Private Easement

Leak Indication Classification  
1 2 3  
(Circle One)

## LEAKAGE CONTROL REPORT WATER SURVEY

Company Systemcomp / Four Belvoir District \_\_\_\_\_  
City Accotink State VA  
Nearest Street Address \_\_\_\_\_

Third St. EAST of Gunston Rd.

### INDICATION OF LEAK

Sonic	<input checked="" type="checkbox"/>
Surfaced Water	<input type="checkbox"/>
Other	<input type="checkbox"/>

### ESTIMATION OF LEAKAGE:

<u>4 gpm</u>

### LEAKAGE DETECTED AT:

Main Valve	<input type="checkbox"/>
Curb Valve	<input type="checkbox"/>
Meter Box	<input type="checkbox"/>
Selected Test	<input type="checkbox"/>
Hydrant	<input checked="" type="checkbox"/>
See Remarks	<input type="checkbox"/>

### LEAK APPEARS TO BE ON:

Main	<input type="checkbox"/>
Service	<input type="checkbox"/>
Joint Connection	<input type="checkbox"/>
Hydrant	<input checked="" type="checkbox"/>
Valve	<input type="checkbox"/>
Misc.	<input type="checkbox"/>

### COVER

Concrete	<input type="checkbox"/>
Asphalt	<input type="checkbox"/>
Brick	<input type="checkbox"/>
Gravel	<input type="checkbox"/>
Soil	<input checked="" type="checkbox"/>
Other	<input type="checkbox"/>

### Remarks

Fire hydrant on Third St approx 200 FEET  
EAST of INT of Third St + Gunston Rd LEAKING

MAP- H-8

Small Office



HEATH CONSULTANTS INCORPORATED  
9030 Monroe Road, Houston, TX 77061

Page No. 7  
Date 10-22-95  
Ownership Public Private Easement  
Leak Indication Classification  
1 2 3  
(Circle One)

### LEAKAGE CONTROL REPORT WATER SURVEY

Company Systemcare / Fort Belvoir District \_\_\_\_\_  
City ACCOLINK State VA  
Nearest Street Address \_\_\_\_\_

Third St west of CHAPEK ST

#### INDICATION OF LEAK

Sonic	<input checked="" type="checkbox"/>
Surfaced Water	<input type="checkbox"/>
Other	<input type="checkbox"/>

#### ESTIMATION OF LEAKAGE:

<u>4 gpm</u>

#### LEAKAGE DETECTED AT:

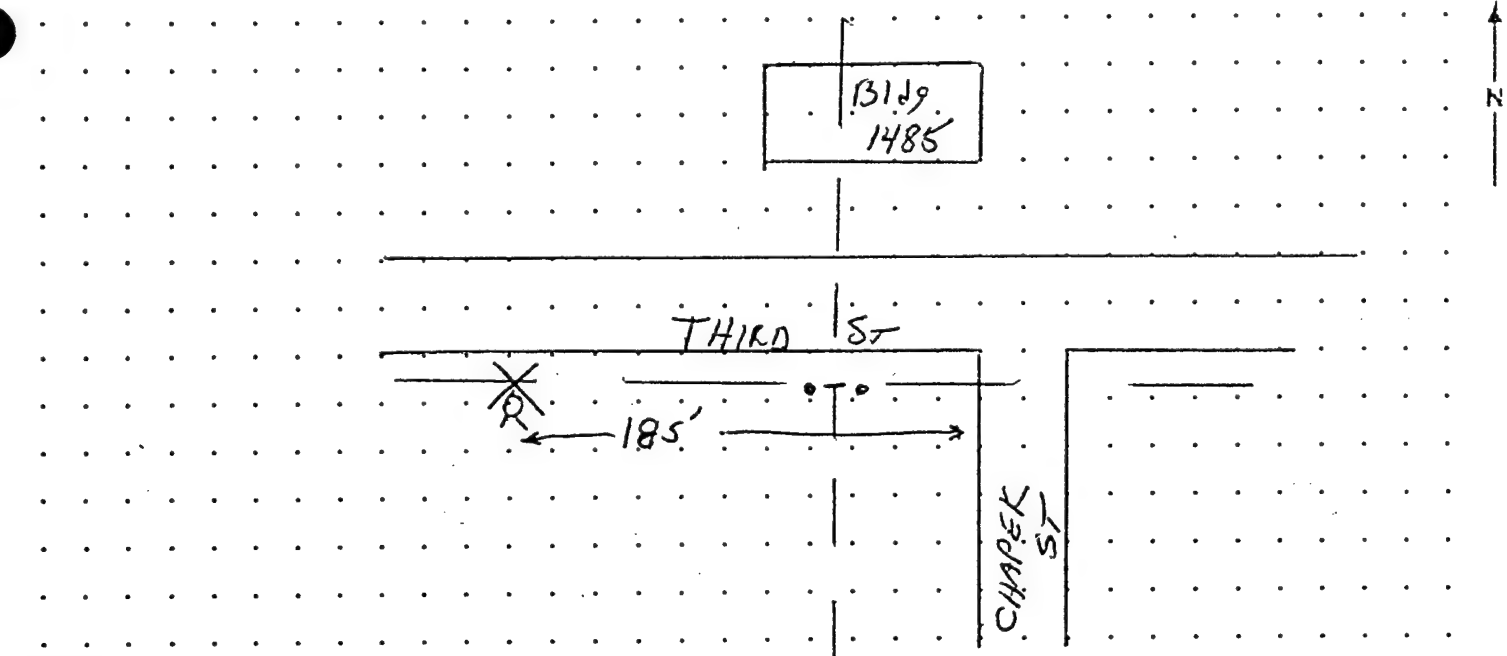
Main Valve	<input type="checkbox"/>
Curb Valve	<input type="checkbox"/>
Meter Box	<input type="checkbox"/>
Selected Test	<input type="checkbox"/>
Hydrant	<input checked="" type="checkbox"/>
	<input type="checkbox"/>
See Remarks	<input type="checkbox"/>

#### LEAK APPEARS TO BE ON:

Main	<input type="checkbox"/>
Service	<input type="checkbox"/>
Joint Connection	<input type="checkbox"/>
Hydrant	<input checked="" type="checkbox"/>
Valve	<input type="checkbox"/>
Misc.	<input type="checkbox"/>

#### COVER

Concrete	<input type="checkbox"/>
Asphalt	<input type="checkbox"/>
Brick	<input type="checkbox"/>
Gravel	<input type="checkbox"/>
Soil	<input checked="" type="checkbox"/>
Other	<input type="checkbox"/>



Remarks Fine hydrant on Third St approx 185' west  
of int of THIRD ST & CHAPEK ST LEAKING

MAP H-8

David C. Murray  
Heath Consultant



HEATH CONSULTANTS INCORPORATED  
9030 Monroe Road, Houston, TX 77061

Page No. 8

Date 6-23-95

Ownership Public Private Easement

Leak Indication Classification  
1 2 3  
(Circle One)

### LEAKAGE CONTROL REPORT WATER SURVEY

Company Systemcomp / Fort Belvoir District \_\_\_\_\_

City Accotink State VA

Nearest Street Address

GUSTON ROAD AT #1195 - FIRE HYDRANT

#### INDICATION OF LEAK

Sonic	<input checked="" type="checkbox"/>
Surfaced Water	<input type="checkbox"/>
Other	<input type="checkbox"/>

#### ESTIMATION OF LEAKAGE:

<u>1 gpm</u>

#### LEAKAGE DETECTED AT:

Main Valve	<input type="checkbox"/>
Curb Valve	<input type="checkbox"/>
Meter Box	<input type="checkbox"/>
Selected Test	<input type="checkbox"/>
Hydrant	<input checked="" type="checkbox"/>
	<input type="checkbox"/>
See Remarks	<input type="checkbox"/>

#### LEAK APPEARS TO BE ON:

Main	<input type="checkbox"/>
Service	<input type="checkbox"/>
Joint Connection	<input type="checkbox"/>
Hydrant	<input checked="" type="checkbox"/>
Valve	<input type="checkbox"/>
Misc.	<input type="checkbox"/>

#### COVER

Concrete	<input type="checkbox"/>
Asphalt	<input type="checkbox"/>
Brick	<input type="checkbox"/>
Gravel	<input type="checkbox"/>
Soil	<input checked="" type="checkbox"/>
Other	<input type="checkbox"/>

#### Remarks

Fire hydrant in grass in front of  
Building #1195 leaking

MAP J-8

Danell Munn



HEATH CONSULTANTS INCORPORATED  
9030 Monroe Road, Houston, TX 77061

Page No. 9  
Date 6-26-85  
Ownership Public Private Easement  
Leak Indication Classification  
1 2 3  
(Circle One)

## LEAKAGE CONTROL REPORT WATER SURVEY

Company Systemscorp / Fr Belvoir District \_\_\_\_\_  
City ACLOTINE State Va  
Nearest Street Address

Gunston Rd at # S-1147

### INDICATION OF LEAK

Sonic	<input checked="" type="checkbox"/>
Surfaced Water	<input type="checkbox"/>
Other	<input type="checkbox"/>

### ESTIMATION OF LEAKAGE:

<u>10 gpm</u>

### LEAKAGE DETECTED AT:

Main Valve	<input checked="" type="checkbox"/>
Curb Valve	<input type="checkbox"/>
Meter Box	<input type="checkbox"/>
Selected Test	<input type="checkbox"/>
Hydrant	<input type="checkbox"/>
	<input type="checkbox"/>
See Remarks	<input type="checkbox"/>

### LEAK APPEARS TO BE ON:

Main	<input checked="" type="checkbox"/>
Service	<input type="checkbox"/>
Joint Connection	<input type="checkbox"/>
Hydrant	<input type="checkbox"/>
Valve	<input type="checkbox"/>
Misc.	<input type="checkbox"/>

### COVER

Concrete	<input type="checkbox"/>
Asphalt	<input type="checkbox"/>
Brick	<input type="checkbox"/>
Gravel	<input type="checkbox"/>
Soil	<input checked="" type="checkbox"/>
Other	<input type="checkbox"/>

### Remarks

LEAK on 8" MAIN off 12" MAIN. LEAK IS  
Behind CURBLINE south of Building # S-1147. LEAK  
IS approx 30' South of South Building Wall of # S-1147  
AND approx 10' WEST of WEST CURB LINE of Gunston Rd  
ACROSS ROAD FROM INTER of Gunston Rd + 14TH ST

MAP J-8

*Donnell M. ...*  
Heath Consultants





HEATH CONSULTANTS INCORPORATED  
9030 Monroe Road, Houston, TX 77061

Page No. 10  
Date 6-26-93  
Ownership Public Private Easement  
Leak Indication Classification  
1 2 3  
(Circle One)

### LEAKAGE CONTROL REPORT WATER SURVEY

Company Systemcomp / Ft Belvoir District \_\_\_\_\_  
City ACCOLINK State VA  
Nearest Street Address

Belvoir Road behind #1000

#### INDICATION OF LEAK

Sonic	<input checked="" type="checkbox"/>
Surfaced Water	<input checked="" type="checkbox"/>
Other	<input type="checkbox"/>

#### ESTIMATION OF LEAKAGE:

<u>3 gpm</u>

#### LEAKAGE DETECTED AT:

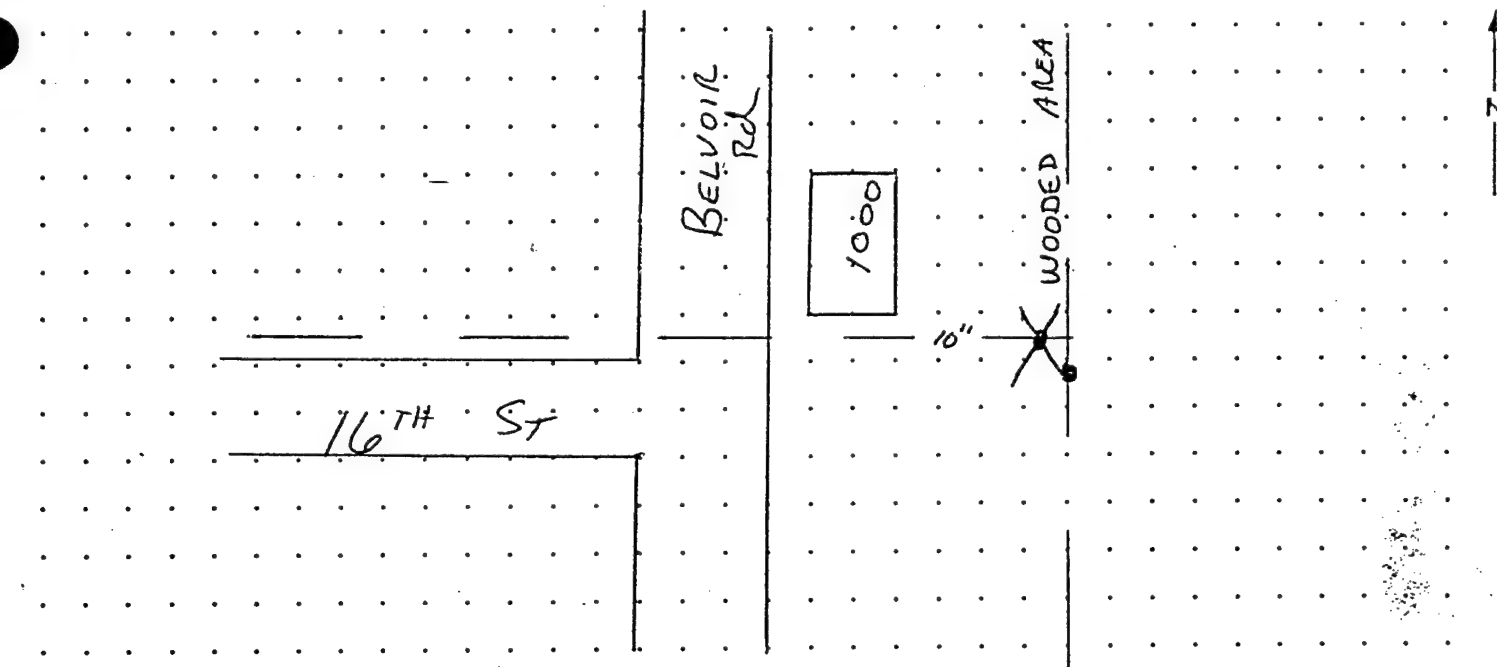
Main Valve	<input checked="" type="checkbox"/>
Curb Valve	<input type="checkbox"/>
Meter Box	<input type="checkbox"/>
Selected Test	<input type="checkbox"/>
Hydrant	<input type="checkbox"/>
	<input type="checkbox"/>
See Remarks	<input type="checkbox"/>

#### LEAK APPEARS TO BE ON:

Main	<input checked="" type="checkbox"/>
Service	<input type="checkbox"/>
Joint Connection	<input type="checkbox"/>
Hydrant	<input type="checkbox"/>
Valve	<input type="checkbox"/>
Misc.	<input type="checkbox"/>

#### COVER

Concrete	<input type="checkbox"/>
Asphalt	<input type="checkbox"/>
Brick	<input type="checkbox"/>
Gravel	<input type="checkbox"/>
Soil	<input checked="" type="checkbox"/>
Other	<input type="checkbox"/>



#### Remarks

LEAK APPEARS to be on MAIN, AT OR NEAR  
VALVE (possible Flange) on ~~main~~ line running WEST along  
side of Building #1000. LEAK & VALVES ARE IN WOODED AREA  
Behind Building #1000.

MAP J-9

Donall Murray  
Heath Consultant



HEATH CONSULTANTS INCORPORATED  
9030 Monroe Road, Houston, TX 77061

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Ownership Public Private Easement  
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1 2 3  
(Circle One)

### LEAKAGE CONTROL REPORT WATER SURVEY

Company System corp / Font Belvoir District \_\_\_\_\_  
City ALLOTINK State VA  
Nearest Street Address

12<sup>th</sup> ST AT # 1017 (BARDEN School)

#### INDICATION OF LEAK

Sonic	<input checked="" type="checkbox"/>
Surfaced Water	<input checked="" type="checkbox"/>
Other	<input type="checkbox"/>

#### ESTIMATION OF LEAKAGE:

<u>2 gpm</u>
--------------

#### LEAKAGE DETECTED AT:

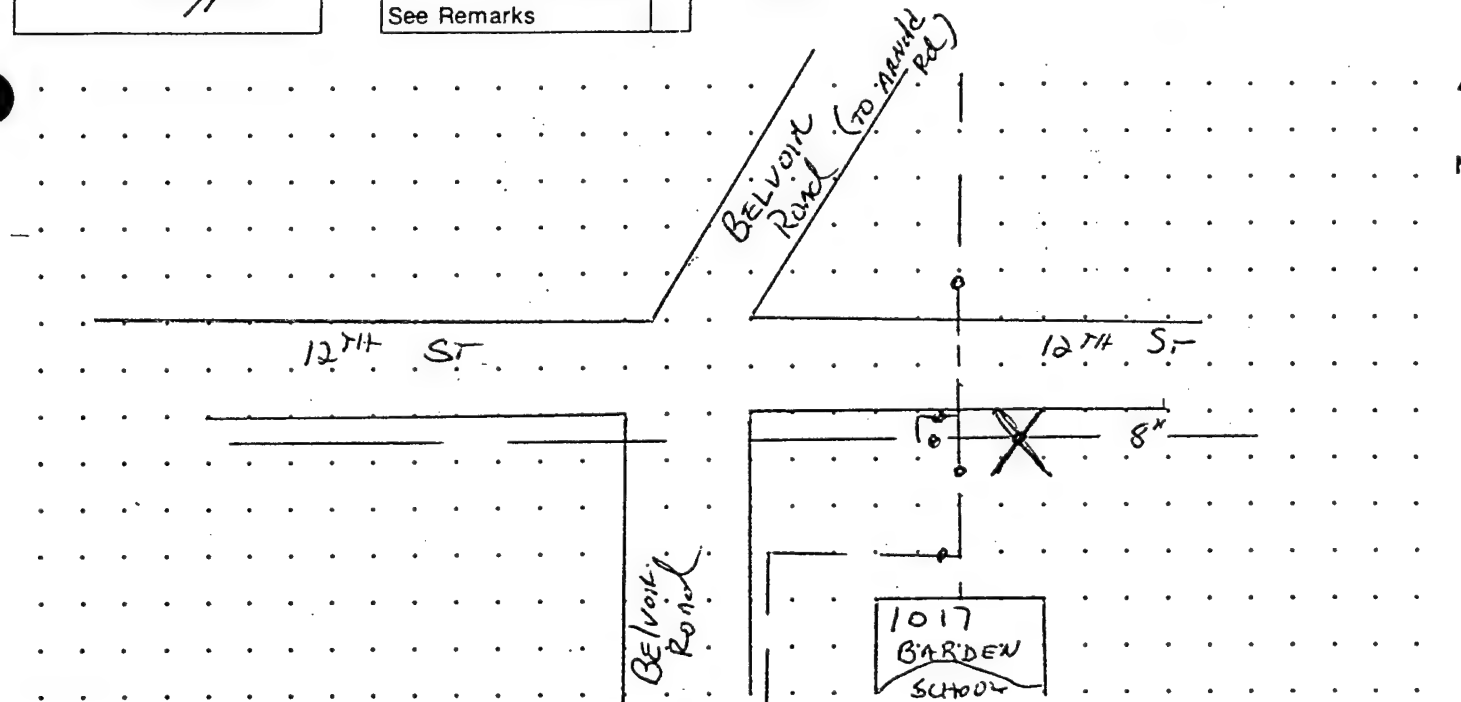
Main Valve	<input checked="" type="checkbox"/>
Curb Valve	<input type="checkbox"/>
Meter Box	<input type="checkbox"/>
Selected Test	<input type="checkbox"/>
Hydrant	<input type="checkbox"/>
See Remarks	<input type="checkbox"/>

#### LEAK APPEARS TO BE ON:

Main	<input type="checkbox"/>
Service	<input type="checkbox"/>
Joint Connection	<input type="checkbox"/>
Hydrant	<input type="checkbox"/>
Valve	<input checked="" type="checkbox"/>
Misc.	<input type="checkbox"/>

#### COVER

Concrete	<input type="checkbox"/>
Asphalt	<input type="checkbox"/>
Brick	<input type="checkbox"/>
Gravel	<input type="checkbox"/>
Soil	<input checked="" type="checkbox"/>
Other	<input type="checkbox"/>



#### Remarks

8" valve controlling flow EAST on 12<sup>th</sup> ST  
FROM VALVE GROUP ALONG 12<sup>th</sup> ST IN FRONT OF # 1017  
(BARDEN School). LEAKING - WATER SURFACING

MAR J-9

[Signature]  
Heath Consultants



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(Circle One)

### LEAKAGE CONTROL REPORT WATER SURVEY

Company Systemcamp/Fort Belvoir District \_\_\_\_\_  
City Accotink State VA  
Nearest Street Address

Arnold Road south of 9th St

#### INDICATION OF LEAK

Sonic	<input checked="" type="checkbox"/>
Surfaced Water	<input type="checkbox"/>
Other	<input type="checkbox"/>

#### ESTIMATION OF LEAKAGE:

<u>10 gpm</u>

#### LEAKAGE DETECTED AT:

Main Valve	<input checked="" type="checkbox"/>
Curb Valve	<input type="checkbox"/>
Meter Box	<input type="checkbox"/>
Selected Test	<input type="checkbox"/>
Hydrant	<input type="checkbox"/>
	<input type="checkbox"/>
See Remarks	<input type="checkbox"/>

#### LEAK APPEARS TO BE ON:

Main	<input checked="" type="checkbox"/>
Service	<input type="checkbox"/>
Joint Connection	<input type="checkbox"/>
Hydrant	<input type="checkbox"/>
Valve	<input type="checkbox"/>
Misc.	<input type="checkbox"/>

#### COVER

Concrete	<input type="checkbox"/>
Asphalt	<input type="checkbox"/>
Brick	<input type="checkbox"/>
Gravel	<input type="checkbox"/>
Soil	<input checked="" type="checkbox"/>
Other	<input type="checkbox"/>

#### Remarks

LEAK appears to be 8" main along EAST  
SHOULDER of ARNOLD ST 161' south of main valve  
on Arnold Rd at INT of ARNOLD Rd + 9TH ST

MAP I-8

Daniel M. Mum  
Heath Consultant



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(Circle One)

## LEAKAGE CONTROL REPORT WATER SURVEY

Company Systemcorp/IT Belvoir District \_\_\_\_\_  
City ACCOLINK State Vs  
Nearest Street Address

MEERES Road AT #1741

### INDICATION OF LEAK

Sonic	<input checked="" type="checkbox"/>
Surfaced Water	<input type="checkbox"/>
Other	<input type="checkbox"/>

### ESTIMATION OF LEAKAGE:

<u>1 gpm</u>

### LEAKAGE DETECTED AT:

Main Valve	<input type="checkbox"/>
Curb Valve	<input type="checkbox"/>
Meter Box	<input type="checkbox"/>
Selected Test	<input type="checkbox"/>
Hydrant	<input type="checkbox"/>
See Remarks	<input checked="" type="checkbox"/>

### LEAK APPEARS TO BE ON:

Main	<input checked="" type="checkbox"/>
Service	<input type="checkbox"/>
Joint Connection	<input type="checkbox"/>
Hydrant	<input type="checkbox"/>
Valve	<input type="checkbox"/>
Misc.	<input type="checkbox"/>

### COVER

Concrete	<input type="checkbox"/>
Asphalt	<input type="checkbox"/>
Brick	<input type="checkbox"/>
Gravel	<input type="checkbox"/>
Soil	<input type="checkbox"/>
Other <u>manhole</u>	<input checked="" type="checkbox"/>

1741  
CHENEY  
School

MEERES Rd

Knight St

### Remarks

LEAK ON 2" TAP FOR AIR RELEASE VALVE ON 16"  
IN MANHOLE IN FRONT OF #1741 MEERES RD (CHENEY School)

\* Air release NOT ATTACHED TO 2" TAP

MAP-F-8

NO MAP of this ARE.

Donell C. Miller



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Ownership Public Private Easement

Leak Indication Classification  
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### LEAKAGE CONTROL REPORT WATER SURVEY

Company Systemcorp / Ft Belvoir District \_\_\_\_\_

City ACLOTINK State VA

Nearest Street Address \_\_\_\_\_

12" MAIN VALVE AT Building # 1003

#### INDICATION OF LEAK

Sonic	<input checked="" type="checkbox"/>
Surfaced Water	<input checked="" type="checkbox"/>
Other	<input type="checkbox"/>

#### ESTIMATION OF LEAKAGE:

<u>2 gpm</u>

#### LEAKAGE DETECTED AT:

Main Valve	<input checked="" type="checkbox"/>
Curb Valve	<input type="checkbox"/>
Meter Box	<input type="checkbox"/>
Selected Test	<input type="checkbox"/>
Hydrant	<input type="checkbox"/>
	<input type="checkbox"/>
See Remarks	<input type="checkbox"/>

#### LEAK APPEARS TO BE ON:

Main	<input type="checkbox"/>
Service	<input type="checkbox"/>
Joint Connection	<input type="checkbox"/>
Hydrant	<input type="checkbox"/>
Valve	<input checked="" type="checkbox"/>
Misc.	<input type="checkbox"/>

#### COVER

Concrete	<input type="checkbox"/>
Asphalt	<input type="checkbox"/>
Brick	<input type="checkbox"/>
Gravel	<input type="checkbox"/>
Soil	<input checked="" type="checkbox"/>
Other	<input type="checkbox"/>

#### Remarks

12" MAIN VALVE IN Front of Building #1003  
- Youth Activity Services - LEAKING

WATER SURFACING

MAP J-9

David C. Munn  
Heath Consultant



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Ownership Public Private Easement  
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1 2 3  
(Circle One)

### LEAKAGE CONTROL REPORT WATER SURVEY

Company System Corp / Ft Belvoir District \_\_\_\_\_  
City Acclotine State VA  
Nearest Street Address

HURLEY Road AT #805

#### INDICATION OF LEAK

Sonic	<input checked="" type="checkbox"/>
Surfaced Water	<input type="checkbox"/>
Other	<input type="checkbox"/>

#### ESTIMATION OF LEAKAGE:

<u>3 gpm</u>

#### LEAKAGE DETECTED AT:

Main Valve	<input type="checkbox"/>
Curb Valve	<input type="checkbox"/>
Meter Box	<input type="checkbox"/>
Selected Test	<input type="checkbox"/>
Hydrant	<input checked="" type="checkbox"/>
	<input type="checkbox"/>
See Remarks	<input type="checkbox"/>

#### LEAK APPEARS TO BE ON:

Main	<input type="checkbox"/>
Service	<input type="checkbox"/>
Joint Connection	<input type="checkbox"/>
Hydrant	<input checked="" type="checkbox"/>
Valve	<input type="checkbox"/>
Misc.	<input type="checkbox"/>

#### COVER

Concrete	<input type="checkbox"/>
Asphalt	<input type="checkbox"/>
Brick	<input type="checkbox"/>
Gravel	<input type="checkbox"/>
Soil	<input checked="" type="checkbox"/>
Other	<input type="checkbox"/>

← 12TH ST →

805

HURLEY Road

#### Remarks

Fire hydrant on Hurley Road NEAR WEST  
SIDE OF Building #805 LEAKING

MAP - J-9

*[Signature]*  
Heath Consultants



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1 2 3  
(Circle One)

## LEAKAGE CONTROL REPORT WATER SURVEY

Company Systemcorp / Ft Belvoir District \_\_\_\_\_  
City ACCO RINK State VA  
Nearest Street Address

16TH ST AT #740

### INDICATION OF LEAK

Sonic	<input checked="" type="checkbox"/>
Surfaced Water	<input checked="" type="checkbox"/>
Other	<input type="checkbox"/>

### ESTIMATION OF LEAKAGE:

<u>25 gpm</u>

### LEAKAGE DETECTED AT:

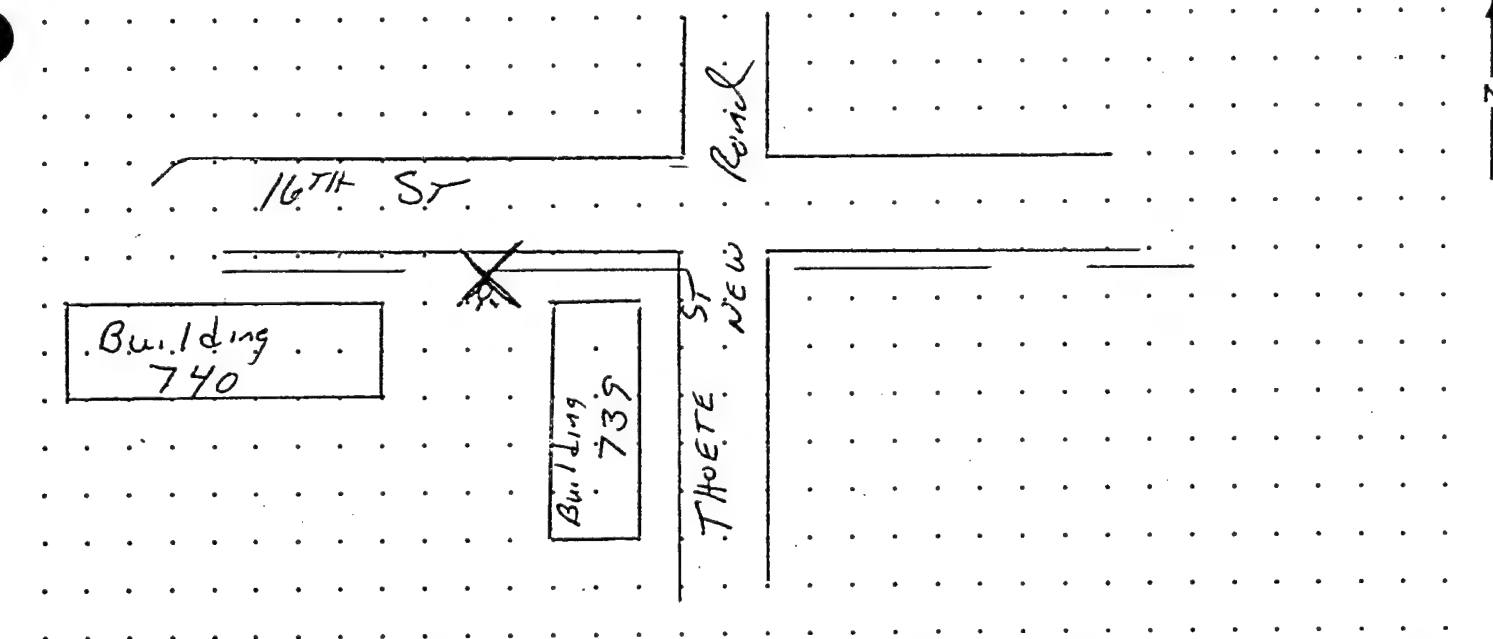
Main Valve	<input type="checkbox"/>
Curb Valve	<input type="checkbox"/>
Meter Box	<input type="checkbox"/>
Selected Test	<input type="checkbox"/>
Hydrant	<input checked="" type="checkbox"/>
	<input type="checkbox"/>
See Remarks	<input type="checkbox"/>

### LEAK APPEARS TO BE ON:

Main <u>Hyd Lat</u>	<input checked="" type="checkbox"/>
Service	<input type="checkbox"/>
Joint Connection	<input type="checkbox"/>
Hydrant	<input type="checkbox"/>
Valve	<input type="checkbox"/>
Misc.	<input type="checkbox"/>

### COVER

Concrete	<input type="checkbox"/>
Asphalt	<input type="checkbox"/>
Brick	<input type="checkbox"/>
Gravel	<input type="checkbox"/>
Soil	<input checked="" type="checkbox"/>
Other	<input type="checkbox"/>



### Remarks

LEAK appears to be at FIRE hydrant, possibly hyd  
LATERAL AT FIRE hyd on 16TH ST Between Buildings # 739  
& 740

MAP K-8

Donald C. Mearl  
Heath Consultant



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(Circle One)

### LEAKAGE CONTROL REPORT WATER SURVEY

Company Systemcorp / Ft Belvoir District \_\_\_\_\_  
City Accotink State VA  
Nearest Street Address

16TH ST West of Dalrymple St

#### INDICATION OF LEAK

Sonic	<input checked="" type="checkbox"/>
Surfaced Water	<input type="checkbox"/>
Other	<input type="checkbox"/>

#### ESTIMATION OF LEAKAGE:

<u>1 gpm</u>

#### LEAKAGE DETECTED AT:

Main Valve	<input type="checkbox"/>
Curb Valve	<input type="checkbox"/>
Meter Box	<input type="checkbox"/>
Selected Test	<input type="checkbox"/>
Hydrant	<input checked="" type="checkbox"/>
	<input type="checkbox"/>
See Remarks	<input type="checkbox"/>

#### LEAK APPEARS TO BE ON:

Main	<input type="checkbox"/>
Service	<input type="checkbox"/>
Joint Connection	<input type="checkbox"/>
Hydrant	<input checked="" type="checkbox"/>
Valve	<input type="checkbox"/>
Misc.	<input type="checkbox"/>

#### COVER

Concrete	<input type="checkbox"/>
Asphalt	<input type="checkbox"/>
Brick	<input type="checkbox"/>
Gravel	<input type="checkbox"/>
Soil	<input checked="" type="checkbox"/>
Other	<input type="checkbox"/>

#### Remarks

Fine hydrant on 16TH ST Between Dalrymple ST & THOETE ST leaking

MAP K-8

David M. Munn  
Heath Consultant





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Leak Indication Classification 1 2 3  
(Circle One)

### LEAKAGE CONTROL REPORT WATER SURVEY

Company Systemcomp / Ft. Belvoir District \_\_\_\_\_  
City ACLOTINK State VA  
Nearest Street Address \_\_\_\_\_

LYMAN Loop at FIRE hydr.

#### INDICATION OF LEAK

Sonic	<input checked="" type="checkbox"/>
Surfaced Water	<input checked="" type="checkbox"/>
Other	<input type="checkbox"/>

#### ESTIMATION OF LEAKAGE:

<u>15 gpm</u>

#### LEAKAGE DETECTED AT:

Main Valve	<input type="checkbox"/>
Curb Valve	<input type="checkbox"/>
Meter Box	<input type="checkbox"/>
Selected Test	<input type="checkbox"/>
Hydrant	<input checked="" type="checkbox"/>
	<input type="checkbox"/>
See Remarks	<input type="checkbox"/>

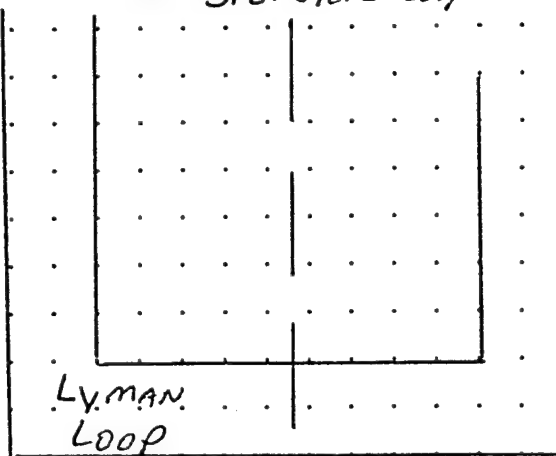
#### LEAK APPEARS TO BE ON:

Main	<input type="checkbox"/>
Service	<input type="checkbox"/>
Joint Connection	<input type="checkbox"/>
Hydrant	<input checked="" type="checkbox"/>
Valve	<input type="checkbox"/>
Misc.	<input type="checkbox"/>

#### COVER

Concrete	<input type="checkbox"/>
Asphalt	<input type="checkbox"/>
Brick	<input type="checkbox"/>
Gravel	<input type="checkbox"/>
Soil	<input type="checkbox"/>
Other	<input checked="" type="checkbox"/>

← SPENGLER Loop →



#### Remarks

Fire hydrant Body at FIRE hydrant on  
Back side of Lyman Loop CRACKED - Fire hydrant  
has 1 1/2" crack in Body

MAP L-8

David M. Murr  
Heath Consultant



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Ownership Public Private Easement

Leak Indication Classification  
1 2 3  
(Circle One)

## LEAKAGE CONTROL REPORT WATER SURVEY

Company Systemcorp / Ft Belvoir District \_\_\_\_\_

City Accotink State VA

Nearest Street Address

SPENGLER Loop AT 21<sup>ST</sup> ST

### INDICATION OF LEAK

Sonic	<input checked="" type="checkbox"/>
Surfaced Water	<input checked="" type="checkbox"/>
Other	<input type="checkbox"/>

### ESTIMATION OF LEAKAGE:

<u>3 gpm</u>

### LEAKAGE DETECTED AT:

Main Valve	<input checked="" type="checkbox"/>
Curb Valve	<input type="checkbox"/>
Meter Box	<input type="checkbox"/>
Selected Test	<input type="checkbox"/>
Hydrant	<input type="checkbox"/>
	<input type="checkbox"/>
See Remarks	<input type="checkbox"/>

### LEAK APPEARS TO BE ON:

Main	<input checked="" type="checkbox"/>
Service	<input type="checkbox"/>
Joint Connection	<input type="checkbox"/>
Hydrant	<input type="checkbox"/>
Valve	<input type="checkbox"/>
Misc.	<input type="checkbox"/>

### COVER

Concrete	<input type="checkbox"/>
Asphalt	<input type="checkbox"/>
Brick	<input type="checkbox"/>
Gravel	<input type="checkbox"/>
Soil	<input checked="" type="checkbox"/>
Other	<input type="checkbox"/>

### Remarks

LEAK on 6" MAIN Running on west side of  
Spengler Loop AT 21<sup>ST</sup> ST - LEAK SURFACING - LEAK  
IS ~ 25' off 21<sup>ST</sup> ST INTO SOIL

MAP K-8

David M. Miller



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Ownership Public Private Easement

Leak Indication Classification  
1 2 3  
(Circle One)

## LEAKAGE CONTROL REPORT WATER SURVEY

Company Systemcorp / Fr Belvoir District \_\_\_\_\_  
City Accotink State VA  
Nearest Street Address \_\_\_\_\_

21<sup>ST</sup> STREET AT REAR OF #165

### INDICATION OF LEAK

Sonic	<input checked="" type="checkbox"/>
Surfaced Water	<input type="checkbox"/>
Other	<input type="checkbox"/>

### ESTIMATION OF LEAKAGE:

<u>20 gpm</u>

### LEAKAGE DETECTED AT:

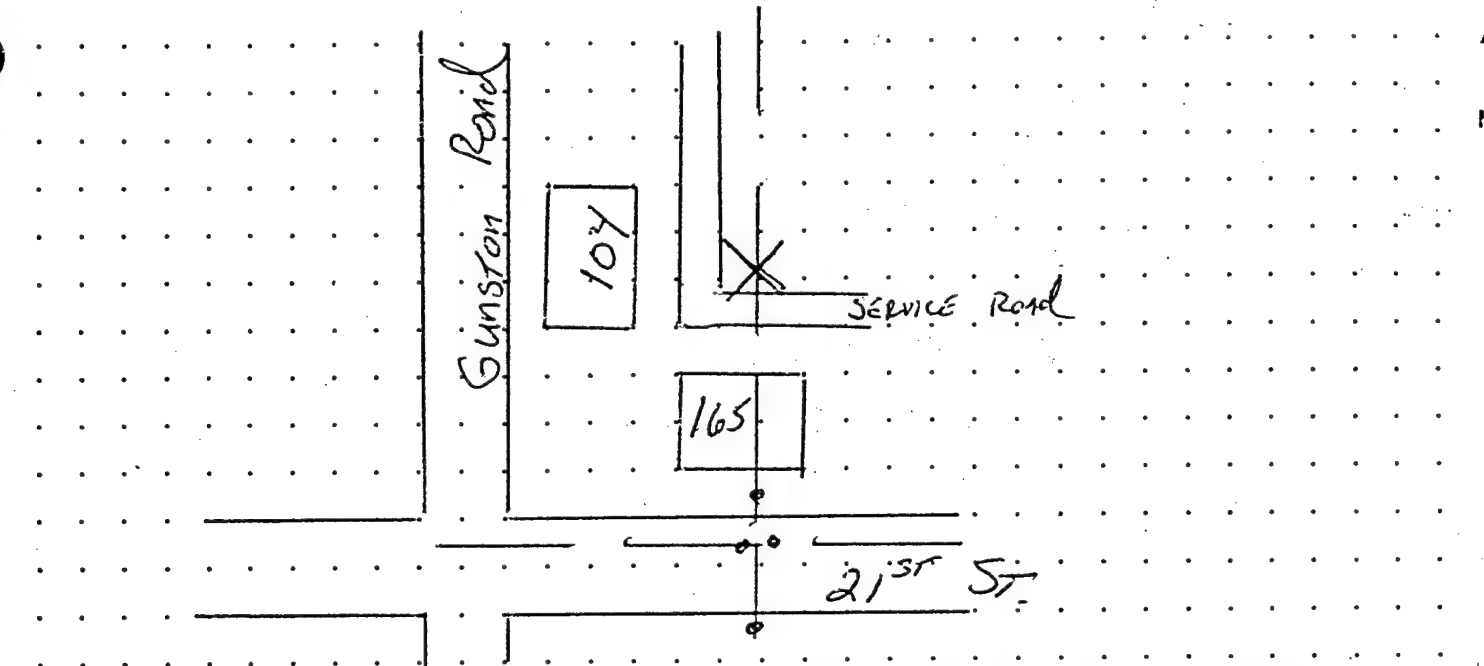
Main Valve	<input checked="" type="checkbox"/>
Curb Valve	<input type="checkbox"/>
Meter Box	<input type="checkbox"/>
Selected Test	<input type="checkbox"/>
Hydrant	<input type="checkbox"/>
	<input type="checkbox"/>
See Remarks	<input type="checkbox"/>

### LEAK APPEARS TO BE ON:

Main	<input checked="" type="checkbox"/>
Service	<input type="checkbox"/>
Joint Connection	<input type="checkbox"/>
Hydrant	<input type="checkbox"/>
Valve	<input type="checkbox"/>
Misc.	<input type="checkbox"/>

### COVER

Concrete	<input type="checkbox"/>
Asphalt	<input type="checkbox"/>
Brick	<input type="checkbox"/>
Gravel	<input type="checkbox"/>
Soil	<input checked="" type="checkbox"/>
Other	<input type="checkbox"/>



### Remarks

LEAK APPEARS to be on MAIN along north  
SIDE of SERVICE ROAD Behind #165 21<sup>ST</sup> ST

MAP- K-9

Donell Miller  
Heath Consultant



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1 2 3  
(Circle One)

### LEAKAGE CONTROL REPORT WATER SURVEY

Company Systemcomp/Ft Belvoir District \_\_\_\_\_  
City Accotink State VA  
Nearest Street Address

Rossell Loop at 21<sup>st</sup> St

#### INDICATION OF LEAK

Sonic	<input checked="" type="checkbox"/>
Surfaced Water	<input checked="" type="checkbox"/>
Other	<input type="checkbox"/>

#### ESTIMATION OF LEAKAGE:

<u>2 gpm</u>

#### LEAKAGE DETECTED AT:

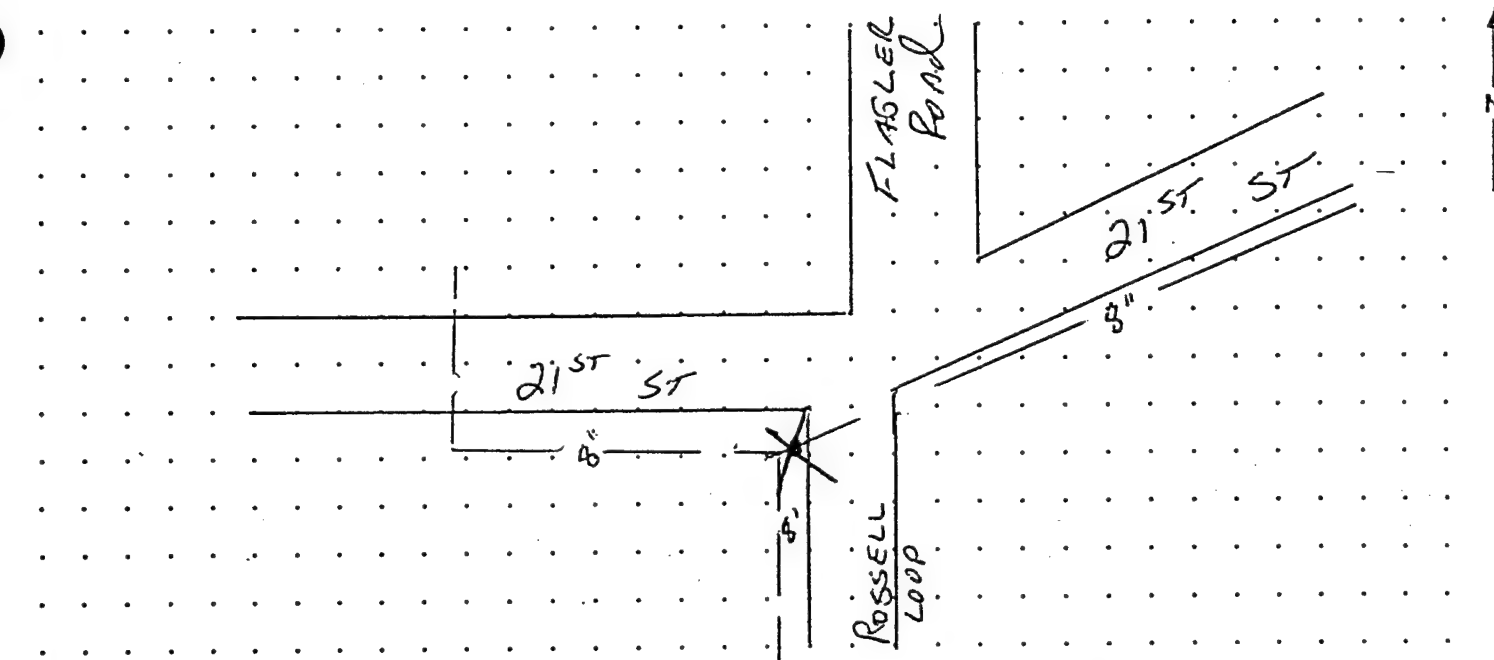
Main Valve	<input checked="" type="checkbox"/>
Curb Valve	<input type="checkbox"/>
Meter Box	<input type="checkbox"/>
Selected Test	<input type="checkbox"/>
Hydrant	<input type="checkbox"/>
	<input type="checkbox"/>
See Remarks	<input type="checkbox"/>

#### LEAK APPEARS TO BE ON:

Main	<input type="checkbox"/>
Service	<input type="checkbox"/>
Joint Connection	<input type="checkbox"/>
Hydrant	<input type="checkbox"/>
Valve	<input checked="" type="checkbox"/>
Misc.	<input type="checkbox"/>

#### COVER

Concrete	<input type="checkbox"/>
Asphalt	<input checked="" type="checkbox"/>
Brick	<input type="checkbox"/>
Gravel	<input type="checkbox"/>
Soil	<input type="checkbox"/>
Other	<input type="checkbox"/>



Remarks 8" MAIN VALVE AT SE. CORNER of int of  
Rossell Loop & 21<sup>st</sup> St. Leaking. WATER SURFACING

Map K-9

*Donald C. Mun...*



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1 2 3  
(Circle One)

## LEAKAGE CONTROL REPORT WATER SURVEY

Company Systemcomp/AT Belvoir District \_\_\_\_\_  
City Accotink State VA  
Nearest Street Address \_\_\_\_\_

18TH ST AT REAR of #130

### INDICATION OF LEAK

Sonic	<input checked="" type="checkbox"/>
Surfaced Water	<input type="checkbox"/>
Other	<input type="checkbox"/>

### ESTIMATION OF LEAKAGE:

<u>3 gpm</u>

### LEAKAGE DETECTED AT:

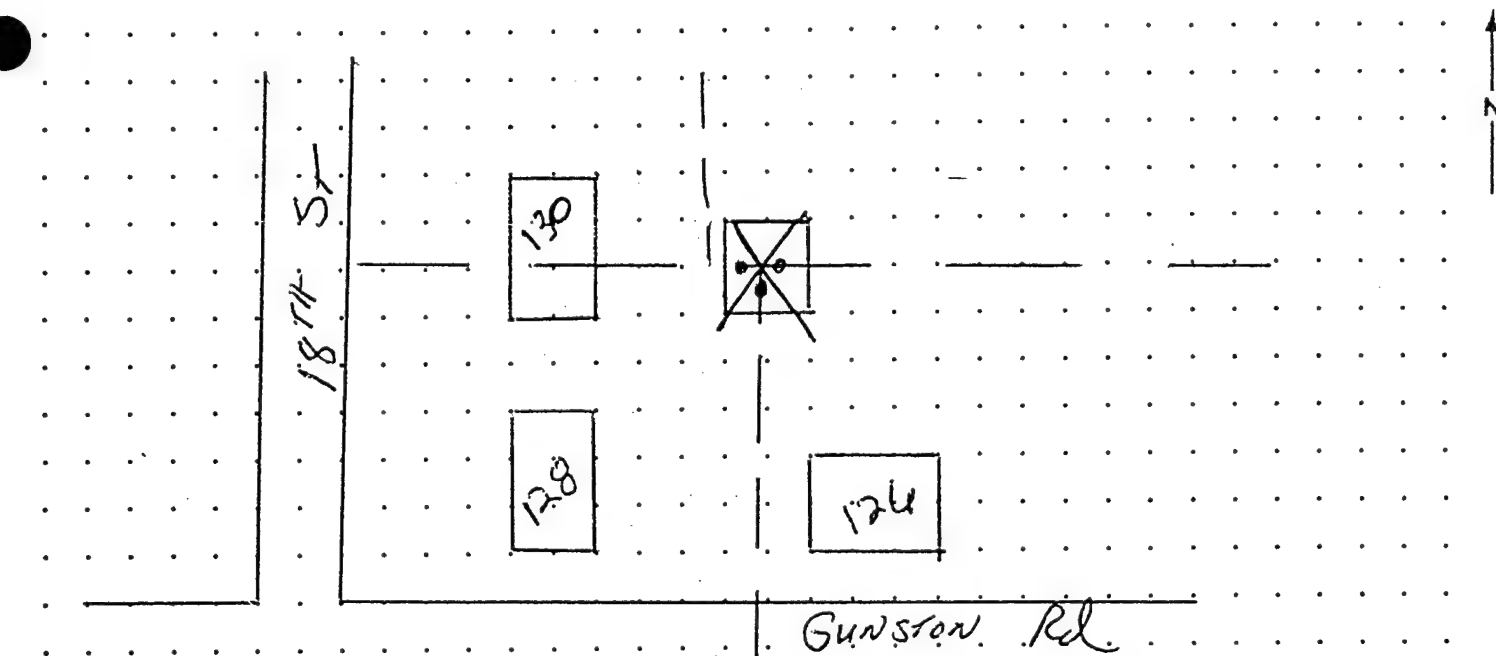
Main Valve	<input checked="" type="checkbox"/>
Curb Valve	<input type="checkbox"/>
Meter Box	<input type="checkbox"/>
Selected Test	<input type="checkbox"/>
Hydrant	<input type="checkbox"/>
	<input type="checkbox"/>
See Remarks	<input type="checkbox"/>

### LEAK APPEARS TO BE ON:

Main	<input type="checkbox"/>
Service	<input type="checkbox"/>
Joint Connection	<input type="checkbox"/>
Hydrant	<input type="checkbox"/>
Valve <u>in PIT</u>	<input checked="" type="checkbox"/>
Misc.	<input type="checkbox"/>

### COVER

Concrete	<input type="checkbox"/>
Asphalt	<input type="checkbox"/>
Brick	<input type="checkbox"/>
Gravel	<input type="checkbox"/>
Soil	<input type="checkbox"/>
Other <u>PIT</u>	<input checked="" type="checkbox"/>



### Remarks

LEAK APPEARS TO BE ON VALVE IN VALVE PIT AT  
REAR of #130 18TH ST. PIT IS FULL of WATER  
SO EXACTLY WHICH VALVE IS LEAKING CANNOT BE DETERMINED

MAP-K-8

Dorel M. J.



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(Circle One)

### LEAKAGE CONTROL REPORT WATER SURVEY

Company Systemcomp / IT Belvoir District \_\_\_\_\_  
City ACCOITEX State VA  
Nearest Street Address

GOETHALS Road AT BEAUREGARD Rd

#### INDICATION OF LEAK

Sonic	<input checked="" type="checkbox"/>
Surfaced Water	<input type="checkbox"/>
Other	<input type="checkbox"/>

#### ESTIMATION OF LEAKAGE:

<u>1 gpm</u>

#### LEAKAGE DETECTED AT:

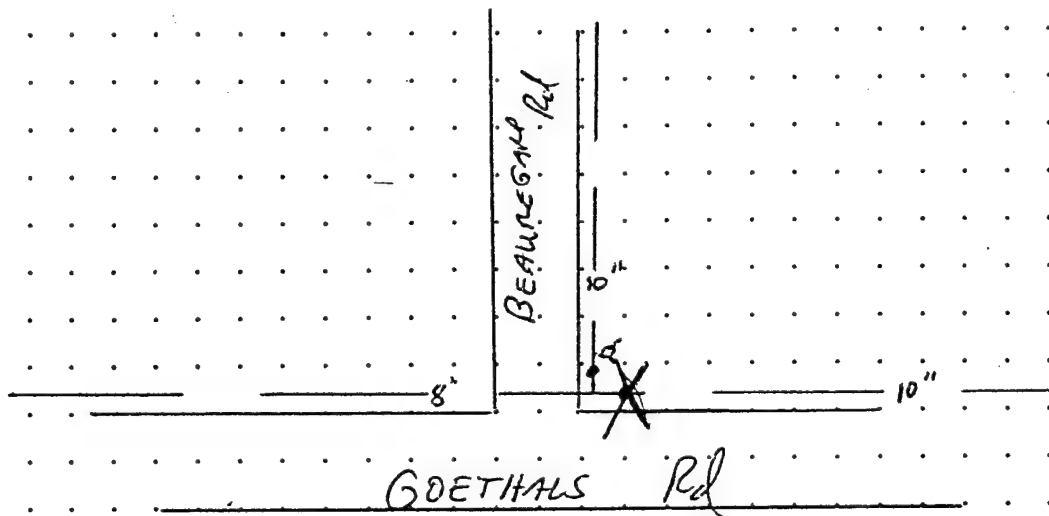
Main Valve	<input checked="" type="checkbox"/>
Curb Valve	<input type="checkbox"/>
Meter Box	<input type="checkbox"/>
Selected Test	<input type="checkbox"/>
Hydrant	<input type="checkbox"/>
	<input type="checkbox"/>
See Remarks	<input type="checkbox"/>

#### LEAK APPEARS TO BE ON:

Main	<input type="checkbox"/>
Service	<input type="checkbox"/>
Joint Connection	<input type="checkbox"/>
Hydrant	<input type="checkbox"/>
Valve	<input checked="" type="checkbox"/>
Misc.	<input type="checkbox"/>

#### COVER

Concrete	<input type="checkbox"/>
Asphalt	<input type="checkbox"/>
Brick	<input type="checkbox"/>
Gravel	<input type="checkbox"/>
Soil	<input checked="" type="checkbox"/>
Other	<input type="checkbox"/>



#### Remarks

10" MAIN VALVE CONTROLLING WATER FLOW EAST  
ON GOETHALS ROAD FROM INT WITH BEAUREGARD Rd  
1/24/99

MAI-6-8

[Signature]  
Heath Consultant



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(Circle One)

## LEAKAGE CONTROL REPORT WATER SURVEY

Company Systemcorp / Ft Belvoir District \_\_\_\_\_  
City Accotink State VA  
Nearest Street Address \_\_\_\_\_

IRY Road AT #1970

### INDICATION OF LEAK

Sonic	<input checked="" type="checkbox"/>
Surfaced Water	<input checked="" type="checkbox"/>
Other	<input type="checkbox"/>

### ESTIMATION OF LEAKAGE:

<u>3.9 gpm</u>

### LEAKAGE DETECTED AT:

Main Valve	<input checked="" type="checkbox"/>
Curb Valve	<input type="checkbox"/>
Meter Box	<input type="checkbox"/>
Selected Test	<input type="checkbox"/>
Hydrant	<input checked="" type="checkbox"/>
See Remarks	<input type="checkbox"/>

### LEAK APPEARS TO BE ON:

Main	<input type="checkbox"/>
Service	<input type="checkbox"/>
Joint Connection	<input type="checkbox"/>
Hydrant	<input checked="" type="checkbox"/>
Valve	<input type="checkbox"/>
Misc.	<input type="checkbox"/>

### COVER

Concrete	<input type="checkbox"/>
Asphalt	<input type="checkbox"/>
Brick	<input type="checkbox"/>
Gravel	<input type="checkbox"/>
Soil	<input checked="" type="checkbox"/>
Other	<input type="checkbox"/>

### Remarks

Fire hydrant AT REAR of #1970 IRY Road  
LEAKING

A POSSIBLE SECOND LEAK HERE - maybe 12" x 6'  
FROM TIE IN. TOO MUCH MUD, WATER & CAT TAILS  
TO LOCATE EXACT SOURCE OF SURFACING  
water



HEATH CONSULTANTS INCORPORATED  
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1 2 3  
(Circle One)

### LEAKAGE CONTROL REPORT WATER SURVEY

Company Systemcorp / Ft Belvoir District \_\_\_\_\_  
City ACCOLINK State VA  
Nearest Street Address \_\_\_\_\_

IRY Rd AT #1972

#### INDICATION OF LEAK

Sonic	<input checked="" type="checkbox"/>
Surfaced Water	<input checked="" type="checkbox"/>
Other	<input type="checkbox"/>

#### ESTIMATION OF LEAKAGE:

<u>2 gpm</u>

#### LEAKAGE DETECTED AT:

Main Valve	<input type="checkbox"/>
Curb Valve	<input type="checkbox"/>
Meter Box	<input type="checkbox"/>
Selected Test	<input type="checkbox"/>
Hydrant	<input checked="" type="checkbox"/>
	<input type="checkbox"/>
See Remarks	<input type="checkbox"/>

#### LEAK APPEARS TO BE ON:

Main	<input type="checkbox"/>
Service	<input type="checkbox"/>
Joint Connection	<input type="checkbox"/>
Hydrant	<input checked="" type="checkbox"/>
Valve	<input type="checkbox"/>
Misc.	<input type="checkbox"/>

#### COVER

Concrete	<input type="checkbox"/>
Asphalt	<input type="checkbox"/>
Brick	<input type="checkbox"/>
Gravel	<input type="checkbox"/>
Soil	<input checked="" type="checkbox"/>
Other	<input type="checkbox"/>

12" IRY Road FH

1970	1971	1972	1973
------	------	------	------

#### Remarks

Fire hydrant across IRY Road from Building #1972  
leaking

MAP H-7

Daniel M. Munn  
Heath Consultants





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### LEAKAGE CONTROL REPORT WATER SURVEY

Company Systemcomp/FT Belvoir District \_\_\_\_\_  
City ACCLTINK State VA  
Nearest Street Address

ABBOT Road AT #2115

#### INDICATION OF LEAK

Sonic	<input checked="" type="checkbox"/>
Surfaced Water	<input type="checkbox"/>
Other	<input type="checkbox"/>

#### ESTIMATION OF LEAKAGE:

<u>1 gpm</u>

#### LEAKAGE DETECTED AT:

Main Valve	<input type="checkbox"/>
Curb Valve	<input type="checkbox"/>
Meter Box	<input type="checkbox"/>
Selected Test	<input type="checkbox"/>
Hydrant	<input checked="" type="checkbox"/>
	<input type="checkbox"/>
See Remarks	<input type="checkbox"/>

#### LEAK APPEARS TO BE ON:

Main	<input type="checkbox"/>
Service	<input type="checkbox"/>
Joint Connection	<input type="checkbox"/>
Hydrant	<input checked="" type="checkbox"/>
Valve	<input type="checkbox"/>
Misc.	<input type="checkbox"/>

#### COVER

Concrete	<input type="checkbox"/>
Asphalt	<input type="checkbox"/>
Brick	<input type="checkbox"/>
Gravel	<input type="checkbox"/>
Soil	<input checked="" type="checkbox"/>
Other	<input type="checkbox"/>

ABBOT Road

X FH

2115

#### Remarks

Fine hydrant AT N.W corner of Building  
# 2115 (NORTH HEALTH CLINIC) ON ABBOT ROAD LEAKING

MAP G-7

David C. Miller



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(Circle One)

## LEAKAGE CONTROL REPORT WATER SURVEY

Company System Corp / Ft Belvoir District \_\_\_\_\_  
City Accotink State VA  
Nearest Street Address

16th St at Building # 193

### INDICATION OF LEAK

Sonic	<input checked="" type="checkbox"/>
Surfaced Water	<input type="checkbox"/>
Other	<input type="checkbox"/>

### ESTIMATION OF LEAKAGE:

<u>10 gpm</u>

### LEAKAGE DETECTED AT:

Main Valve	<input checked="" type="checkbox"/>
Curb Valve	<input type="checkbox"/>
Meter Box	<input type="checkbox"/>
Selected Test	<input type="checkbox"/>
Hydrant	<input type="checkbox"/>
	<input type="checkbox"/>
See Remarks	<input type="checkbox"/>

### LEAK APPEARS TO BE ON:

Main	<input checked="" type="checkbox"/>
Service	<input type="checkbox"/>
Joint Connection	<input type="checkbox"/>
Hydrant	<input type="checkbox"/>
Valve	<input type="checkbox"/>
Misc.	<input type="checkbox"/>

### COVER

Concrete	<input type="checkbox"/>
Asphalt	<input checked="" type="checkbox"/>
Brick	<input type="checkbox"/>
Gravel	<input type="checkbox"/>
Soil	<input type="checkbox"/>
Other	<input type="checkbox"/>

Gunston Rd

193

12' LOWEN Rd

701

### Remarks

LEAK APPEARS to be on 6" MAIN RUNNING  
EAST FROM 16th St Between Buildings # 193 & 701  
LEAK IS approx 12' EAST of 6" MAIN VALVE AT INT  
of 16th St & Access Road Between Buildings (LOWEN Rd)  
193 & 701

David C. Miller MAP K-8  
Heath Consultant



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### LEAKAGE CONTROL REPORT WATER SURVEY

Company Systemcorp / Ft Belvoir District \_\_\_\_\_  
City Accotink State VA  
Nearest Street Address

Theote Rd NEAR S-628

#### INDICATION OF LEAK

Sonic	<input checked="" type="checkbox"/>
Surfaced Water	<input checked="" type="checkbox"/>
Other	<input type="checkbox"/>

#### ESTIMATION OF LEAKAGE:

<u>100 gpm</u>

#### LEAKAGE DETECTED AT:

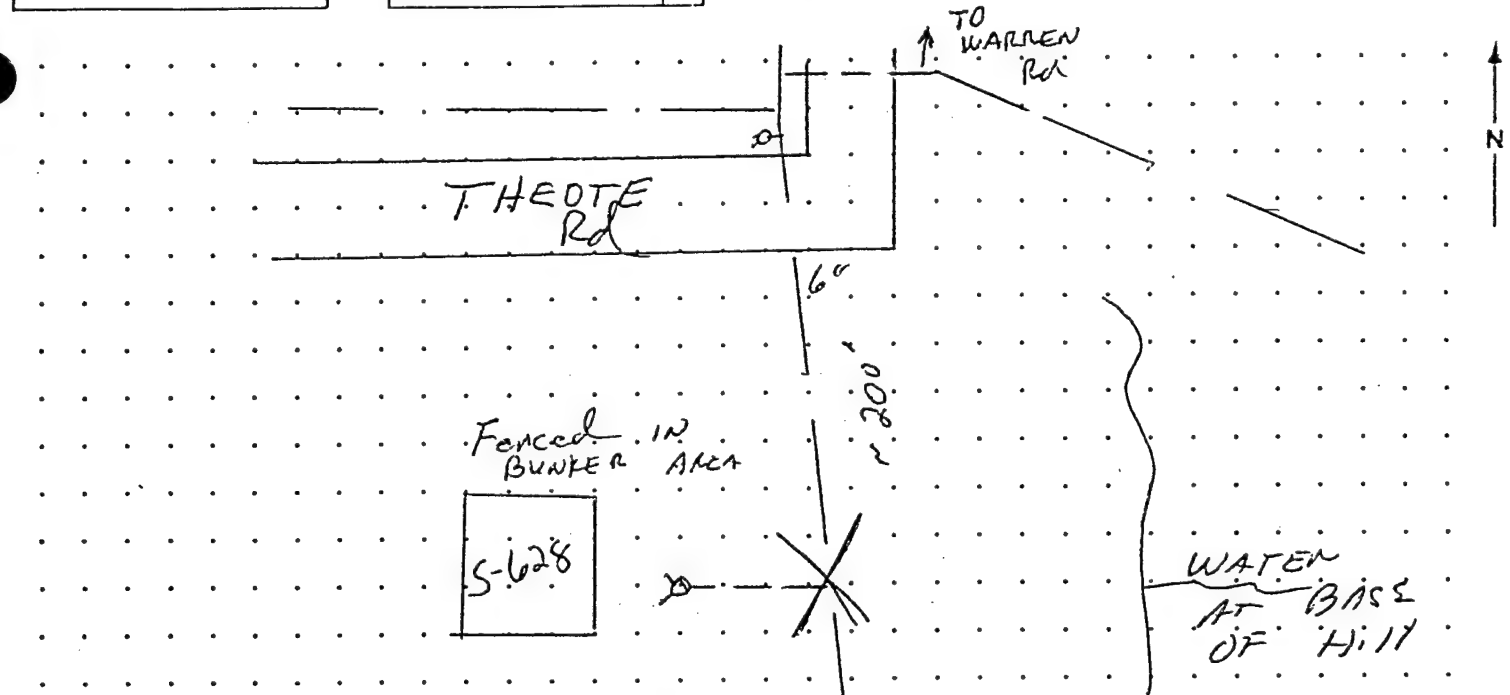
Main Valve	<input checked="" type="checkbox"/>
Curb Valve	<input type="checkbox"/>
Meter Box	<input type="checkbox"/>
Selected Test	<input type="checkbox"/>
Hydrant	<input type="checkbox"/>
	<input type="checkbox"/>
See Remarks	<input type="checkbox"/>

#### LEAK APPEARS TO BE ON:

Main	<input checked="" type="checkbox"/>
Service	<input type="checkbox"/>
Joint Connection	<input type="checkbox"/>
Hydrant	<input type="checkbox"/>
Valve	<input type="checkbox"/>
Misc.	<input type="checkbox"/>

#### COVER

Concrete	<input type="checkbox"/>
Asphalt	<input type="checkbox"/>
Brick	<input type="checkbox"/>
Gravel	<input type="checkbox"/>
Soil	<input checked="" type="checkbox"/>
Other	<input type="checkbox"/>



#### Remarks

LEAK appears to be on 6" main in right of way off of Theote Road. LEAK is in AREA of FIRE hydrant "T" AREA BUILDING S-628

MAP L-8

*David M. [Signature]*  
Heath Consultant



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### LEAKAGE CONTROL REPORT WATER SURVEY

Company Systemcorp/Ft Belvoir District \_\_\_\_\_  
City Accotink State VA  
TOTTEN Rd AT #338 <sup>Bldg</sup> Nearest Street Address

#### INDICATION OF LEAK

Sonic	<input checked="" type="checkbox"/>
Surfaced Water	<input type="checkbox"/>
Other	<input type="checkbox"/>

#### ESTIMATION OF LEAKAGE:

<u>1 gpm</u>

#### LEAKAGE DETECTED AT:

Main Valve	<input type="checkbox"/>
Curb Valve	<input type="checkbox"/>
Meter Box	<input type="checkbox"/>
Selected Test	<input type="checkbox"/>
Hydrant	<input checked="" type="checkbox"/>
	<input type="checkbox"/>
See Remarks	<input type="checkbox"/>

#### LEAK APPEARS TO BE ON:

Main	<input type="checkbox"/>
Service	<input type="checkbox"/>
Joint Connection	<input type="checkbox"/>
Hydrant	<input checked="" type="checkbox"/>
Valve	<input type="checkbox"/>
Misc.	<input type="checkbox"/>

#### COVER

Concrete	<input type="checkbox"/>
Asphalt	<input type="checkbox"/>
Brick	<input type="checkbox"/>
Gravel	<input type="checkbox"/>
Soil	<input checked="" type="checkbox"/>
Other	<input type="checkbox"/>

#### Remarks

Fine Hydrant across TOTEN Road from BUILDING  
#338 LEAKING

MSP M-9

Danish M. M. J.



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(Circle One)

### LEAKAGE CONTROL REPORT WATER SURVEY

Company Systemcomp / Ft Belvoir District \_\_\_\_\_  
City ACCOINK State VA  
Nearest Street Address \_\_\_\_\_

DAVISON AIRFIELD FT BUILDING # 1357

#### INDICATION OF LEAK

Sonic	<input checked="" type="checkbox"/>
Surfaced Water	<input checked="" type="checkbox"/>
Other	<input type="checkbox"/>

#### ESTIMATION OF LEAKAGE:

<u>1 gpm</u>

#### LEAKAGE DETECTED AT:

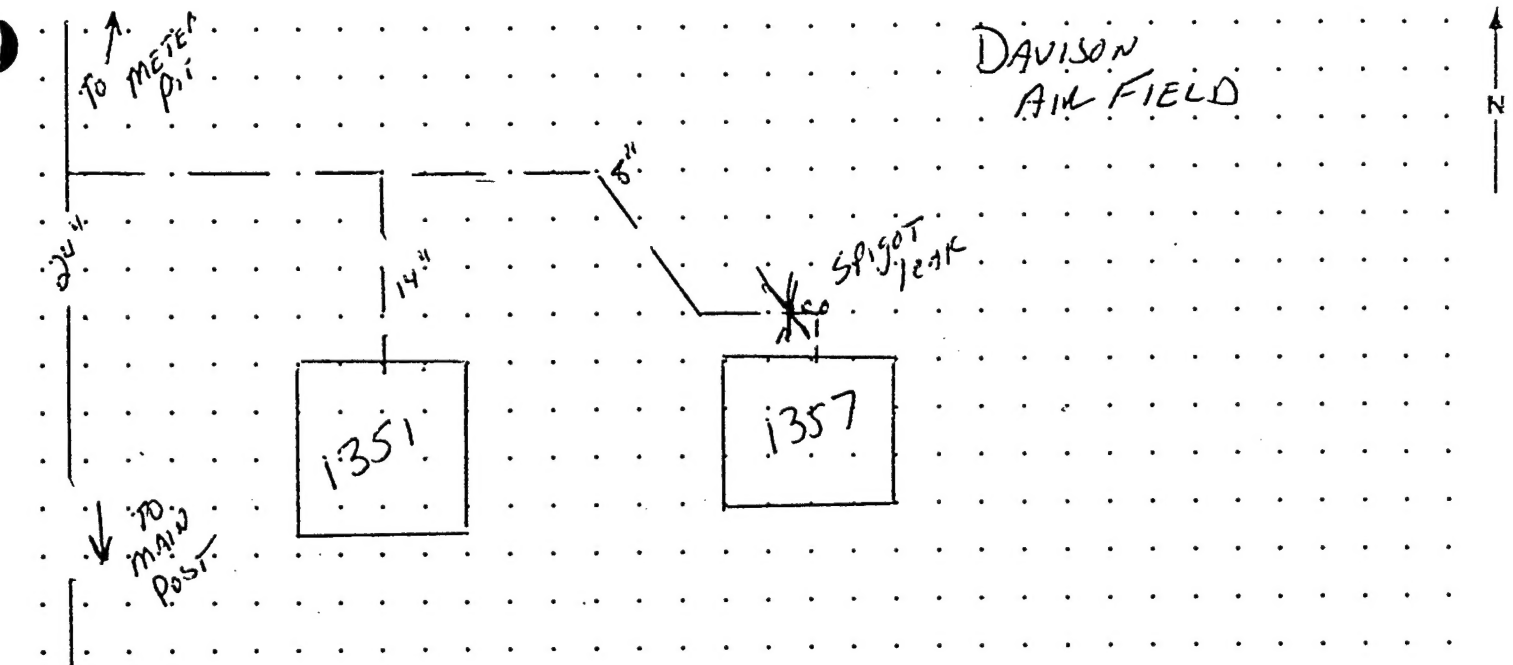
Main Valve	<input type="checkbox"/>
Curb Valve	<input type="checkbox"/>
Meter Box	<input type="checkbox"/>
Selected Test	<input checked="" type="checkbox"/>
Hydrant	<input type="checkbox"/>
	<input type="checkbox"/>
See Remarks	<input type="checkbox"/>

#### LEAK APPEARS TO BE ON:

Main	<input type="checkbox"/>
Service	<input checked="" type="checkbox"/>
Joint Connection	<input type="checkbox"/>
Hydrant	<input type="checkbox"/>
Valve	<input type="checkbox"/>
Misc.	<input type="checkbox"/>

#### COVER

Concrete	<input type="checkbox"/>
Asphalt	<input type="checkbox"/>
Brick	<input type="checkbox"/>
Gravel	<input type="checkbox"/>
Soil	<input checked="" type="checkbox"/>
Other	<input type="checkbox"/>



#### Remarks

OUTSIDE YARD SPIGOT LEAKING AT BASE  
WATER SURFACING

G-5

Donell C. Miller



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(Circle One)

### LEAKAGE CONTROL REPORT WATER SURVEY

Company Systemcorp / Fr Belvoir District \_\_\_\_\_  
City Accotink State VA  
Nearest Street Address  
Davidson Airfield Apt # 1351

#### INDICATION OF LEAK

Sonic	<input checked="" type="checkbox"/>
Surfaced Water	<input checked="" type="checkbox"/>
Other	<input type="checkbox"/>

#### ESTIMATION OF LEAKAGE:

<u>1 gpm</u>

#### LEAKAGE DETECTED AT:

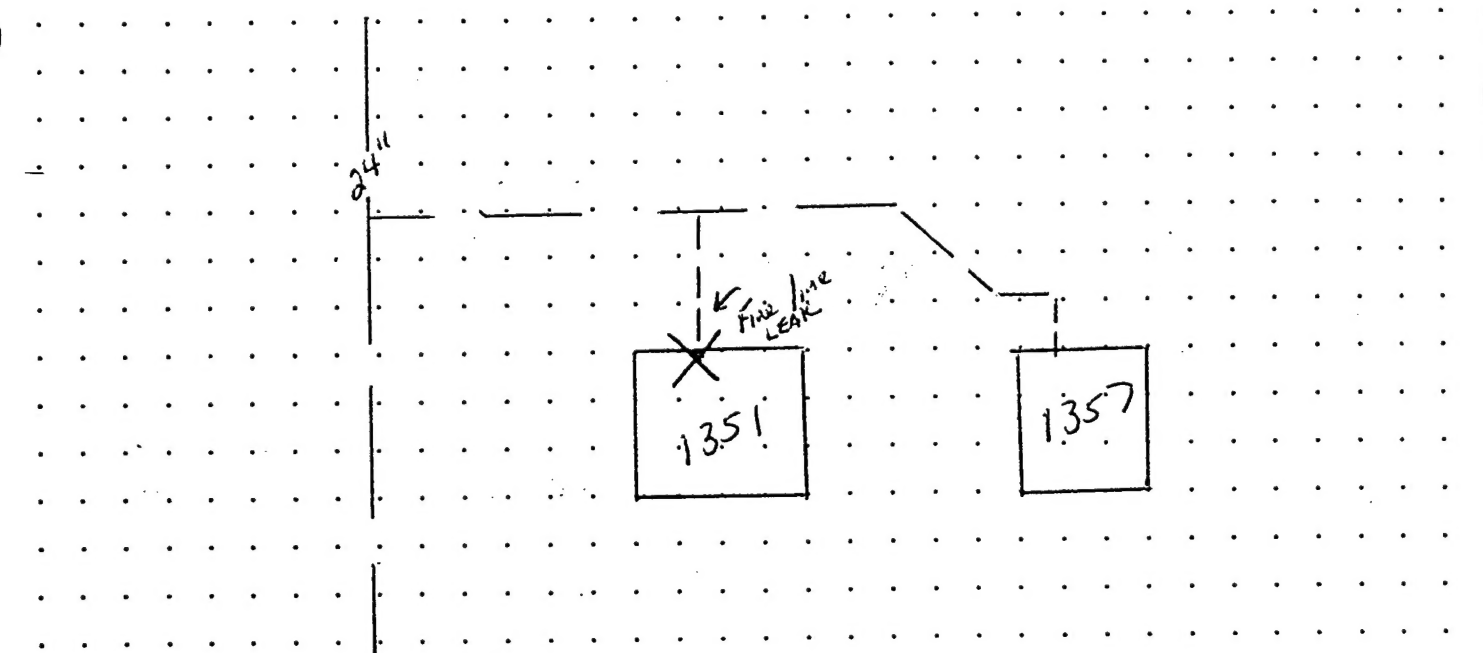
Main Valve	<input type="checkbox"/>
Curb Valve	<input type="checkbox"/>
Meter Box	<input type="checkbox"/>
Selected Test	<input checked="" type="checkbox"/>
Hydrant	<input type="checkbox"/>
	<input type="checkbox"/>
See Remarks	<input type="checkbox"/>

#### LEAK APPEARS TO BE ON:

Main <u>Fire line</u>	<input checked="" type="checkbox"/>
Service	<input type="checkbox"/>
Joint Connection	<input type="checkbox"/>
Hydrant	<input type="checkbox"/>
Valve	<input type="checkbox"/>
Misc.	<input type="checkbox"/>

#### COVER

Concrete	<input type="checkbox"/>
Asphalt	<input type="checkbox"/>
Brick	<input type="checkbox"/>
Gravel	<input type="checkbox"/>
Soil	<input type="checkbox"/>
Other	<input checked="" type="checkbox"/>



#### Remarks

Check valve on sprinkler line in Building  
# 1351 leaking through drain line, water coming out  
drain line outside building

MAP 6-5

Donald Conway  
Heath Consultant

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# APPENDIX F

## Acronyms

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## ACRONYMS

AAFES	Army Air Force Exchange System
DEIS	Defense Energy Information System
DOE	Department of Energy
DOE	Department of Energy
ECIP	Energy Conservation Investment Program
EPACT	Energy Policy Act
FEMP	Federal Energy Management Program
GPD	Gallons Per Day
GPF	Gallons Per Flush
GPM	Gallons Per Minute
GPY	Gallons Per Year
KWH	Thousand Watt Hour
LCCID	Life-Cycle Cost in Design
LPD	Liters Per Day
LPF	Liters Per Flush
LPM	Liters Per Minute
LPY	Liters Per Year
MBTU	Millions BTU
MWH	Megawatt Hour
SIOH	Supervision Inspection and Overhead
SIR	Savings-to-Investment Ratio
SOW	Statement of Work
WCO	Water Conservation Opportunity
WSOS	Water Savings Opportunity Survey